

# Annals of the Missouri Botanical Garden

Vol. 30

FEBRUARY, 1943

No. 1

## TAXONOMY OF CLEMATIS SECTION VIORNA<sup>1</sup>

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### INTRODUCTION

The section VIORNA of *Clematis* has received considerable attention from a number of authors, probably in part because of the attractive appearance of some of the species. Nevertheless there has been but one critical treatment of the group as a whole and there exists in the manuals and in the literature in general, a good deal of confusion with regard to many of the species. In the present study, the bibliographical problems involved have yielded to a systematic survey of the literature; the biological problems, of which there are several, for the most part remain, and they have been merely hinted at here.

### HISTORY

In 1753, Linnaeus<sup>2</sup> described the then-known species of *Clematis* under two genera, *Clematis* and *Atragene*, the latter group being distinguished principally by its possession of petaloid staminodia. This delimitation of the genera was adopted generally by the followers of Linnaeus' sexual system.

DeCandolle,<sup>3</sup> in 1818, extended *Clematis* to include three of the four species which Linnaeus included under *Atragene*, and proposed a new genus, *Naravelia*, to accommodate the single remaining Linnaean species, *Atragene zeylanica*. DeCandolle's delimitation of *Clematis* has been followed almost universally, although a number of generic segregates were proposed between the time of Linnaeus and 1842. Only *Viorna* and *Viticella* have received recognition, having been used,

<sup>1</sup> An investigation carried out in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University; subsequently revised and enlarged.

<sup>2</sup> Linnaeus, Sp. Pl. 543. 1753.

<sup>3</sup> DeCandolle, Syst. 1:151-168. 1818; and Prodr. 1:2-10. 1824.

<sup>1</sup> Issued March 22, 1943.

together with *Atragene* and *Clematis*, by such American botanists as Britton, Small, and Rydberg.

Two species of the section VIORNA were known to Linnaeus, and were described by him as *Clematis Viorna* and *C. crispa*. With the description of *C. reticulata* by Walter in 1788, and *C. ochroleuca* by Aiton in 1789, the more important of the eastern species were known. In 1814, Pursh described *C. hirsutissima* from a specimen collected by Lewis and Clark on their return from the Pacific Coast, a species which was rediscovered by Douglas in 1826, and named *C. Douglasii*. Two more entities were added to the section in 1838 with the description by Torrey and Gray of *C. Baldwinii* and *C. Pitcheri*. In 1853, the handsome *C. texensis* came to the attention of Gray, but was unfortunately described by him as the variety *coccinea* of *C. Viorna*. The collections of Dr. Bigelow during the Pacific Railway explorations of 1853 disclosed *C. Bigelovii*. In 1875, *C. Fremontii*, which had been collected by Fremont as early as 1843, was rediscovered and described. Several species from the southeastern states were published in the period between 1890 and 1903, most of which are attributable to Small, and descriptions of occasional new species have appeared from time to time since then.

Account has been given above only of the more important species of the section and their valid description. A large number of names was added to the synonymy by European authors who described American species without an understanding of their range of variation, and sometimes without a knowledge of the bibliography. *C. crispa* and *C. Pitcheri* have suffered particularly on this score, each of them having been described repeatedly as new species, and even having been confused with each other. Many of the names proposed by European authors were based on cultivated material, and it is possible that some of the plants described, in the 'Botanical Magazine,' for instance, were spontaneous hybrids of horticultural origin. Another source of synonymy has been floras of the western states, such as those of Porter, Rydberg, Heller and others.

The first author to recognize the section VIORNA as a separate entity was Spach,<sup>4</sup> who in 1839 proposed the genus *Viorna* to include the species here referred to as *C. crispa*, *C. Viorna* and *C. integrifolia*. Earlier writers, including Torrey and Gray,<sup>5</sup> had for the most part followed Linnaeus in artificially dividing *Clematis* into SCANDENTES and ERECTAE, or equivalent groups. The first critical treatment of any of the species of the section was Gray's<sup>6</sup> review of the climbing species in 1881. James' revision of the genus *Clematis*,<sup>7</sup> is little more than a compilation of descriptions, and Kuntze's monograph<sup>8</sup> is completely unacceptable, at least as far as its treatment of the species of this section is concerned, and has burdened some of the species with a cumbersome synonymy. In 1895, the group appeared for the first time as the section VIORNA of the genus *Clematis* in the

<sup>4</sup> Spach, Hist. Nat. Vég. Phan. 7:268-272. 1839.

<sup>5</sup> Torrey & Gray, Fl. N. Am. 1:7-11. 1838.

<sup>6</sup> Gray in Bot. Mag., pl. 6594. 1881.

<sup>7</sup> James in Jour. Cincin. Soc. Nat. Hist. 6:118-135. 1883.

<sup>8</sup> Kuntze in Verh. Bot. Ver. Brandenb. 26:83-202. 1885.

'Synoptical Flora.'<sup>9</sup> Here Gray's review of 1881 was incorporated in somewhat modified form, but expanded to include the whole genus. To date, it is the only satisfactory monographic treatment which VIORNA has received.

Since the appearance of the 'Synoptical Flora,' the most important departure has been Small's<sup>10</sup> recognition of VIORNA as a genus, in which he has been followed by Britton and Brown<sup>11</sup> and a number of other botanists. Finally should be mentioned Wherry's<sup>12</sup> review of *C. ocbroleuca* and its near relatives, which rectifies a nomenclatorial mix-up of long standing.

In this paper, the section VIORNA is divided into five subsections, which include 18 species and five varieties, as indicated in the following outline:

### Clematis section Viorna

#### Subsection 1. EUVIORNAE

1. *C. Viorna*
- 1a. *C. Viorna* var. *flaccida*
2. *C. Guttigeri*
3. *C. Addisonii*
4. *C. glaucophylla*
5. *C. varicolor*
6. *C. texensis*
7. *C. reticulata*
8. *C. Beadlei*
9. *C. Pitcheri*
- 9a. *C. Pitcheri* var. *filifera*

#### Subsection 2. VITICELLAE

10. *C. crispa*

#### Subsection 3. INTEGRIFOLIAE

11. *C. ocbroleuca*
12. *C. albicoma*
13. *C. viticaulis*
14. *C. Fremontii*
- 14a. *C. Fremontii* var. *Rieblii*

#### Subsection 4. BALDWINIANAE

15. *C. Baldwinii*

#### Subsection 5. HIRSUTISSIMAE

16. *C. hirsutissima*
- 16a. *C. hirsutissima* var. *Scottii*
- 16b. *C. hirsutissima* var. *arizonica*
17. *C. Palmeri*
18. *C. Bigelovii*

<sup>9</sup> Gray, Syn. Fl. N. Am. 1:58. 1895.

<sup>10</sup> Small, Fl. Southeast. U. S. 437-439. 1903.

<sup>11</sup> Britton & Brown, Ill. Fl., ed. 2, 2:122-126. 1913.

<sup>12</sup> Wherry in Jour. Wash. Acad. Sci. 21:194-198. 1931.

## MORPHOLOGICAL FEATURES OF TAXONOMIC VALUE

*Caudex and Roots.*—The species of the section VIORNA are herbaceous perennial vines or erect suffrutescent plants. The persisting structure is a woody caudex with a mass of apparently unbranched fleshy roots, in the cortex of which is stored a great deal of starch. Growth in the spring is from lateral buds in the apical region of the caudex. There is apparently little propagation of the plants by branching of underground structures.

Neither the caudex nor roots furnished any feature of value in distinguishing species, and the fact that these parts are rarely collected makes them valueless in dealing with herbarium specimens.

*Stem.*—The stem of both the erect species and the vines is usually 6-angled or 6-12-ribbed, and usually quite woody, at least in age. The stem is brittle, breaking in such a way that the "bark" is separated from the wood. Usually the stem is red. In general, it offers poor taxonomic characters, though such features as pubescence, color, angularity and degree of branching are of some value.

*Leaves.*—Many useful characters are found in the leaves. They are decussately opposite, the petioles somewhat clasping to form a stipular (?) collar about the node. They vary from simple and entire in the subsection INTEGRIFOLIAE to multifid in *C. hirsutissima*, or pinnate-ternate in many species of the subsection EUVIORNAE. The degree of compounding is useful in distinguishing many of the species, but it must be used with judgment, since leaves on adjacent plants, or on the same plant, may vary considerably in this character. Also a good deal of variation may be expected in different parts of the geographical range of a single species, as in *C. Pitcheri* and *C. hirsutissima*.

The leaflets of the pinnate leaves of the EUVIORNAE show a marked reduction in size from the base to the tip of each leaf. The distal pair of leaflets is usually very minute, and in place of a terminal leaflet there is usually a tendril-like process. This has been called a tendril by many authors, and indeed it looks very much like one, but it does not appear to be tactile. The twining is by the petiolules of the leaflets or by the rachises. This structure is characteristic of all the climbing species of the section VIORNA, and hence is not of specific value but may be used in characterizing subsections.

Reticulate venation of the leaves is a valuable character. It is not possible to distinguish degrees of reticulation consistently, but lack of reticulation may be contrasted with more or less strong reticulation, and when used in this way the character is a constant one. Glauousness of the leaves characterizes four species of the EUVIORNAE. Little attention has been paid to degrees of pubescence of the leaves. Shape of leaves or leaflets is reliable only in the most general way; particularly is this so of the tips. Characters concerned with the aspect of the leaves, involving such details as proportion of blade to petiolar and rachis tissue, geniculation of the rachis, ascending or drooping attitude, etc., would be valuable if such characters could be put into words.

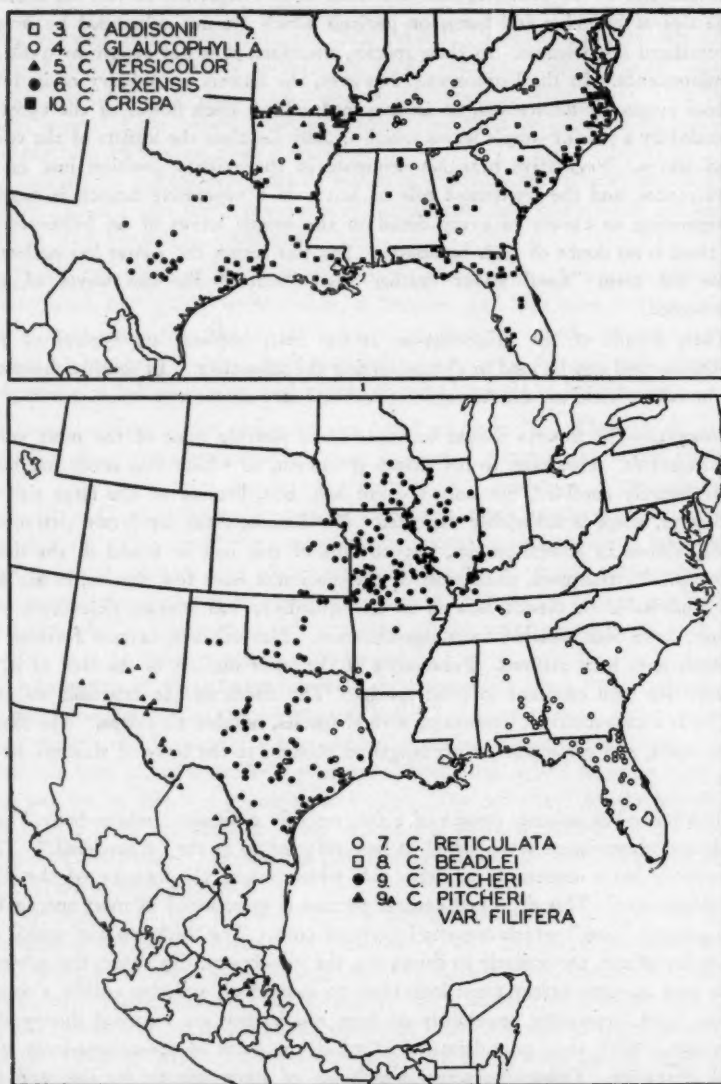
**INFLORESCENCE.**—In the species of the subsections *HIRSUTISSIMAE*, *BALDWINIANAE* and *INTEGRIFOLIAE*, and sometimes in *C. crispa*, the flowers are solitary at the tips of branches and borne on pedicels which are not subtended by bracts or specialized floral leaves. In these species, therefore, it is not proper to speak of an inflorescence. In the *EUVIORNAE*, however, the flowers are solitary or in few-flowered cymose inflorescences, on axillary peduncles. Each flower of the cyme is subtended by a pair of simple leaves which usually simulate the leaflets of the compound leaves. Vegetative branches originate in the axillary position just as do inflorescences, and the lowermost pair of leaves of a vegetative branch is simple, corresponding so closely in every detail to the simple leaves of an inflorescence that there is no doubt of their homology. For this reason the writer has preferred to use the term "floral leaves" rather than "bracts" for the leaves of the inflorescence.

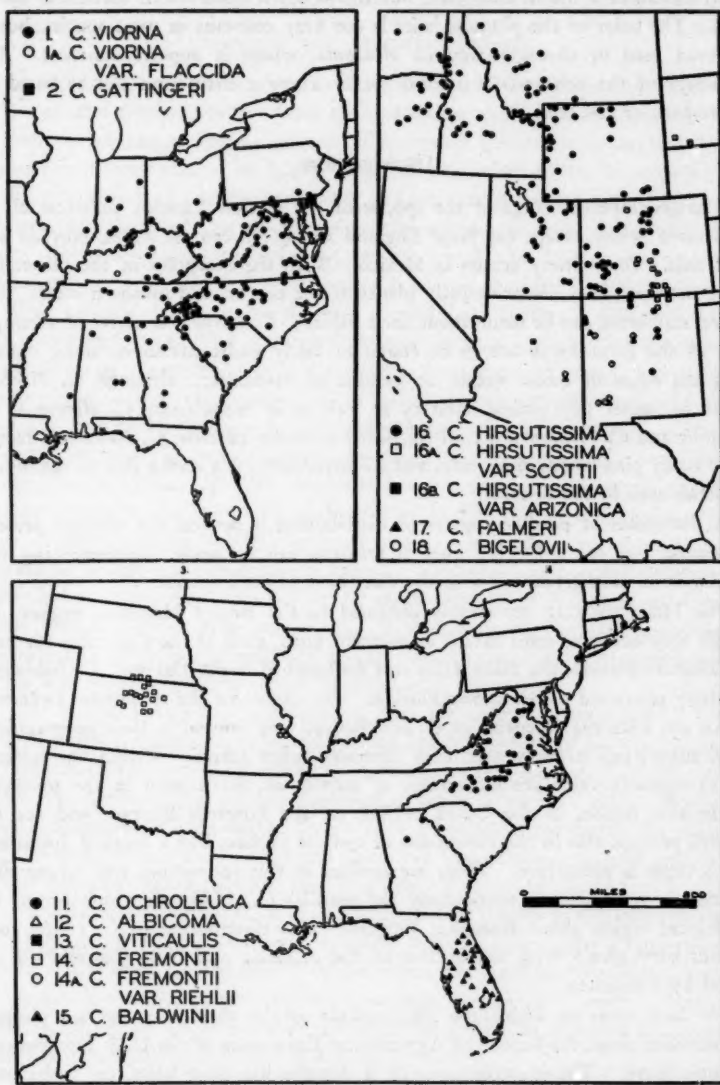
These details of the inflorescence, as has been implied, are typical of the *EUVIORNAE* and can be used in characterizing the subsection. In specific delimitation, however, little use can be made of inflorescence characters.

**Flowers.**—The flowers should be expected to provide some of the most valuable characters. However, in herbarium specimens, to which this study has been almost entirely confined, not only is color lost, but, because of the large size of the flowers, shape is invariably distorted. For instance, the sepals are characteristically ribbed in several species, but no hint of this can be found in the dried specimens. Furthermore, since most of the specimens have few flowers, it has not seemed advisable to dissect flowers in any quantity, and stamen characters, for example, have been omitted from consideration. Nevertheless, certain features of the sepals have been utilized. Pubescence of the outer surface, or the lack of it, is characteristic and constant in most species. The width of the expanded valvate margins is a characteristic feature of several species, notably *C. crispa*. The shape of the sepals, and particularly their length in relation to the body of stamens, have value.

**Achenes.**—The achenes consist of a flat, roughly orbicular "achene-body," and the elongated persistent style, which is here referred to as the "achene-tail." The achene-body has a depression on either side which marks the location of the flat, albuminous seed. This depressed central portion is surrounded in most species by a conspicuous "rim," which consists largely of cork. The thickness and width of the rim are of use, particularly in delimiting the subsections. In shape, the achene-bodies vary to some extent from individual to individual, and also within a single fruiting head, depending apparently on how much they are crowded during development. With these considerations in mind, the shape of the achene-body is a useful character. Other characters which are of some use are its size and its pubescence.

The plumose achene-tails of most of the species are among their most striking characters. The length of the tails is of some value. The way in which they are

Figs. 1-2. Distribution of species of *Clematis* section VIORNA.

Figs. 3-5. Distribution of species of *Clematis* section *Viorna*.

intertwined to form a spherical head, on the one hand, or a spreading mass, on the other, should be a useful character, but this is often distorted in herbarium specimens. The color of the plumose hairs is not very constant in most species, but it has been used in characterizing *C. albicoma*, where it appears constant. The plumosity of the achene-tails is most useful where a distinction can be based on its presence or absence.

#### DISTRIBUTION

The geographical range of the species of the section VIORNA embraces all of the United States except the New England and north-central states, Nevada and California. One variety occurs in Mexico. With the exception of the subsection HIRSUTISSIMAE, they are principally plants of the central and southern states. No general statement can be made about their habitat. *C. crispa* is a native of swamps; most of the EUVIORNAE are to be found in fairly moist situations along creeks, along the edges of moist woods, at mouths of caves, etc., although *C. Pitcheri* occurs in rather dry prairie habitats as well as in woodlands; *C. albicoma*, *C. viticaulis* and *C. Fremontii* are all restricted to rocky barrens; *C. Baldwinii* occurs in the sandy pine woods of Florida; and *C. hirsutissima* is a spring flower, mainly of the shrub zone in the Rockies.

A discussion of possible centers of distribution is beyond the writer's present knowledge, but the following general remarks can be made, supplementing the distributional data given below in the discussion of each species.

The HIRSUTISSIMAE are largely confined to the Rocky Mountain region, although they occur to some extent in adjacent areas, such as the Columbia Plateau, the Colorado Plateau, the Black Hills and Badlands of South Dakota. *C. Baldwinii* is entirely restricted to peninsular Florida. The species of the subsection INTEGRIFOLIAE are, with the exception of *C. ocbroleuca*, very limited in their geographical range, suggesting strongly that they represent relict forms. Within the subsection EUVIORNAE there are indications of centers of distribution in the southern Appalachian region, in the Ozark region, on the Edwards Plateau, and for *C. Pitcheri*, perhaps also in the mountains of central Mexico, but a detailed discussion of this topic is premature. There are entities in this subsection, too, whose distribution is very limited, particularly the peculiar *C. Addisonii*, which occurs in a restricted region about Roanoke, Virginia. The distribution of *C. crispa* corresponds very nicely with the outline of the Atlantic and Gulf Coastal Plain as defined by Fenneman.<sup>13</sup>

The base maps on which the distributions of the various species are plotted were obtained from the Bureau of Agricultural Economics of the U. S. Department of Agriculture. The imperfections of a distribution map based on herbarium records should be recognized; this point is discussed by Pennell.<sup>14</sup> In this paper,

<sup>13</sup> Fenneman, Physiography of Eastern U. S., pl. 3. 1938.

<sup>14</sup> Pennell, Scrophulariaceae of Eastern Temperate N. Am., 542-544. 1935.

all the records at the writer's disposal were plotted, as far as was possible without allowing the symbols (which measure about 15 miles in diameter) to overlap.

#### GENERIC AND SPECIFIC CONCEPT

It is generally agreed that the American species of *Clematis* fall into three more or less natural groups, whether these are regarded as sections of the genus *Clematis* as they are here, or as distinct genera. The section VIORNA is distinguished from the section FLAMMULA by its lack of a paniculate inflorescence, its large leathery sepals, and its lack of a tendency toward dioecism; and from the section ATRAGENE by its lack of petaloid staminodia and by the leathery texture of its erect sepals. Other differences can be pointed out. On the whole, the three groups are so distinct, at least when the American species alone are considered, that the question of their possible generic rank deserves serious consideration. But the sections ATRAGENE and FLAMMULA have very close relatives in Eurasia. Rarely have any Eurasian species been referred to the section (or genus) VIORNA, but it is the writer's opinion that the European *C. Viticella* and *C. integrifolia* should be included in this section because of their resemblance to *C. crispa* and *C. ochroleuca* respectively; and the section should be extended to embrace *C. fusca* of the Kamchatka Peninsula. If this is done the problem arises of what to do with such Chinese species as *C. Henryi*, which have VIORNA-like flowers but produce winter buds on their perennial woody stems, and with *C. lanuginosa*, also of China, which appears to be but one step removed from *C. Viticella*. Such considerations have compelled the writer to define VIORNA conservatively as a section of *Clematis* rather than as a genus in its own right. Furthermore, the author's knowledge of *Clematis* as a whole is not sufficient to rule out the existence of intermediates between VIORNA and the other American sections of the genus.

The section VIORNA, as here treated, does not appear to be a wholly natural one, although the subsections here described are believed to be so. In particular, the subsection HIRSUTISSIMAE seems to be comparatively distant in its relationship to the rest of the section, possibly deserving of separate sectional rank. But in this matter, as in that of the possible generic rank of VIORNA, the author has preferred to follow the conservative course and to reserve any sectional changes until a survey of the entire genus *Clematis* may be made.

Aside from *Naravelia*, which is obviously closely related to *Clematis* and could well be lumped with it, *Clematis* is quite distinct from other Ranunculaceous genera. It is most closely related to *Anemone*; the marked resemblance between *C. hirsutissima* and members of the PULSATILLA section of *Anemone* points to a common ancestry. *C. hirsutissima*, nevertheless, cannot be regarded as congeneric with the species of the section PULSATILLA.

In delimiting the entities within this section, an effort has been made to maintain the species as groups which are not merely morphologically different but which are discrete entities. This emphasis on discreteness, while it could not be followed with complete consistency, has led to the recognition, on the one hand,

of several large species, particularly *C. Pitcheri*, of wide geographical range and great morphological diversity; and, on the other hand, of species and varieties such as *C. Fremontii* var. *Rieblü*, which is separated from the species proper on the basis of rather tenuous differences in size and leaf-shape, but differences which are constant and well supported by geographic isolation. The writer believes that the very different sorts of species which have resulted are not due to inconsistency on his part, but rather that they are, to some extent at least, an expression of a real biological difference in the nature of the groups.

#### CYTOLOGY

Previous to Gregory's<sup>15</sup> cytological study of the Ranunculaceae, there were no published chromosome counts for any species of the section VIORNA. Gregory gives  $n=8$  or  $2n=16$  for *C. Addisonii*, *C. texensis*, *C. crispa*, *C. ochroleuca*, *C. Fremontii*, *C. birsutissima* and *C. birsutissima* var. *Scottii*. The writer has found  $n=8$  in *C. Pitcheri*, *C. versicolor* and *C. Fremontii* var. *Rieblü*. Chromosome numbers of about 30 other species of *Clematis* have been reported, and in these the haploid number is eight with only three exceptions (all cultivated). These data seem to indicate that *Clematis* is one of those genera in which ploidy is rare. Chromosome numbers, in other words, may be expected to be the same throughout the genus, and therefore would be of no significance in interpreting the phylogeny of the group.

Nevertheless, the section appears to be a suitable group for a systematic cytological study, since the chromosomes are relatively large and comparatively few, and there are no serious technical difficulties. Such a study would be expected to throw light upon the relationships of the species, though it would have to go considerably further than a mere counting of the chromosomes.

#### ECONOMIC VALUE

The crushed leaves of certain European species of *Clematis* have been used as a vesicant. The leaves and other plant parts of the VIORNA species also appear to contain an irritating principle. Geyer<sup>16</sup> gives an account of the use of the roots of *C. birsutissima* by the "Sapota" Indians to stimulate their exhausted horses. Dried and powdered leaves of the same species were used as a snuff by Indians of the Northwest, according to a note on a herbarium label. The Seminole Indians of Florida are said to have used a decoction of the roots of *C. Baldwinii* as a remedy for sunstroke.

Some of the species of the section VIORNA have ornamental value, although they cannot compare in showiness with the large-flowered hybrids typified by "*C. Jackmani*," nor in profusion of bloom with the many small-flowered species such as *C. Vitalba*, *C. paniculata*, etc. Their value lies in the curiousness of their urn-shaped flowers. Species of this section will rarely be found planted outside botan-

<sup>15</sup> Gregory in Trans. Am. Phil. Soc., n. s. 31:466-468. 1941.

<sup>16</sup> Geyer in Lond. Jour. Bot. 5:301. 1846.

ical gardens or the gardens of a few discriminating amateurs. Two species are planted more frequently than any others: *C. crispa*, which is distinguished by its broadly winged and undulate sepals, and the red-flowered *C. texensis*. However, other species would seem to have horticultural value, and they have had a champion in the late J. E. Spingarn.<sup>17</sup>

The real horticultural value of these plants, however, will probably be not their use as they are, but rather their employment in the breeding of hybrid varieties. *C. texensis* has been crossed with several of the large-flowered varieties to produce handsome hybrids such as "Countess of Onslow" and "Duchess of Albany."<sup>18</sup> It is probable that other hybrids, utilizing this and other species of the section, will appear in the future.

#### ACKNOWLEDGMENTS

Acknowledgments are due Dr. George T. Moore for necessary library and herbarium facilities; Dr. J. M. Greenman for his invaluable guidance and interest throughout the course of this investigation; and a number of associates and correspondents who have contributed material, data or suggestions.

#### MATERIALS

The specimens examined in the course of this study total over 2,000 numbers, embracing nearly all of the material deposited in the larger American herbaria. The institutions at which the herbaria are located, and the abbreviations by which they are referred to in the citations, are:

- AA—Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts.
- DU—Duke University, Durham, North Carolina.
- FLA—Florida Agricultural Experiment Station, Gainesville, Florida.
- FM—Field Museum of Natural History, Chicago, Illinois.
- G—Gray Herbarium of Harvard University, Cambridge, Mass.
- KS—Kansas State Agricultural College, Manhattan, Kansas.
- MBG—Missouri Botanical Garden, St. Louis, Missouri.
- ND—University of Notre Dame, Notre Dame, Indiana.
- NEB—University of Nebraska, Lincoln, Nebraska.
- NY—New York Botanical Garden, Bronx Park, New York City.
- PA—Academy of Natural Sciences, Philadelphia, Pennsylvania.
- POM—Pomona College, Claremont, California.
- RM—Rocky Mountain Herbarium, University of Wyoming, Laramie, Wyoming.
- TAM—Texas Agricultural Experiment Station, College Station, Texas.
- TEX—University of Texas, Austin, Texas.
- UM—University of Minnesota, Minneapolis, Minnesota.
- UP—University of Pennsylvania, Philadelphia, Pennsylvania.
- US—United States National Museum, Washington, D. C.

<sup>17</sup> Spingarn in Nat. Hort. Mag. 13:76-95. 1934.

<sup>18</sup> Spingarn in Jour. N. Y. Bot. Gard. 37:153-158. 1936.

Type material has been seen for practically all of the species which have been described, excepting only some of the earliest, whose type specimens are in European herbaria. However, these species have for the most part been well understood for many years, and the possibility of misinterpretation is slight.

The author's field experience with *Clematis* is very limited, and he is keenly aware of this fact.

#### TAXONOMY

#### *Clematis* L. Sp. Pl. 543. 1753.

*Clematis* section *Viorna*<sup>19</sup> Gray, Syn. Fl. N. Am. 1:5. 1895; Gray, Man., ed. 7. 403. 1908.

*Viorna*<sup>20</sup> Reich. Handb. 277. 1837; Spach, Hist. Nat. Vég. Phan. 7:268. 1839; Small, Fl. Southeast. U. S. 437. 1903; Rydb. Fl. Rocky Mts. 291. 1917; Rydb. Fl. Prair. & Plains, 335. 1932; Small, Man. Southeast. Fl. 526. 1933.

*Clematis* section *Urnigeræ* Lavallée, Clem. 47. 1884.

Herbaceous perennial vines which climb by twining of the petioles; or erect suffrutescent herbs. Leaves simple or variously compound. Flowers large, perfect, solitary and terminal, or in 1-few-flowered axillary cymose inflorescences, mostly nodding. Sepals 4 (exceptionally 5 or 6), thick or thickish, some shade of blue, red or purple, erect, valvate, connivent for most of their length, slightly spreading to strongly recurved at the apex. Achene-bodies compressed, usually more or less conspicuously rimmed. Achene-tails usually plumose, but sometimes merely pubescent, or naked. Type species of section: *Clematis Viorna* L. Sp. Pl. 543. 1753.

#### ARTIFICIAL KEY TO SPECIES AND VARIETIES

- A. Climbing or ascending plants, usually with twining petioles.
  - B. Leaves glaucous.
    - C. Leaves pinnate-ternate, the leaflets 3 cm. or less long, lobed, ovate, round-tipped ..... 18. *C. Bigelovii*
    - CC. Leaves pinnate or somewhat pinnate-ternate, the leaflets, at least some of them, more than 5 cm. long; leaves sometimes simple.
      - D. Leaves not conspicuously reticulate-veined.
        - E. Ascending; many of the leaves simple, compound leaves 4-6-foliolate; leaflets simple, only one pair large ..... 3. *C. Addisonii*
        - EE. Climbing; compound leaves 8-10-foliolate; leaflets often ternate ..... 4. *C. glaucophylla*
      - DD. Leaves reticulate-veined.

<sup>19</sup> *Viorna* is apparently the Latinized form of the French *viorne*, which is derived from the Latin *Viburnum*. In France, *viorne* applies to a species of *Viburnum* as well as to *Clematis Vitalba*. Linnaeus, for some unexplained reason, applied the specific epithet *Viorna* to the American species which forms the type of this section.

<sup>20</sup> Reichenbach listed *Viorna* as a genus of the *Clematideæ* without description, but with Persoon as authority. In his Syn. Pl. 2:98. 1809, Persoon treats *Viorna* as a section or subsection of *Astragale* for a reason which is hard to understand. It appears, then, that Spach, in the work cited above, was the first to use *Viorna* in its modern sense.

- E. Flowers red; leaflet tips blunt, rounded or emarginate.....6. *C. texensis*
- EE. Flowers lavender or greenish; leaflet tips acute to rounded, not emarginate.....5. *C. versicolor*
- BB. Leaves not glaucous.
  - C. Leaves more or less strongly reticulate-veined.
    - D. Achene-tails plumose.
      - E. Leaflets coriaceous, extremely strongly and closely reticulate-veined, more or less round-tipped.....7. *C. reticulata*
      - EE. Leaflets thinner, more finely and distantly reticulate-veined, tips acute to acuminate.....8. *C. Beadlei*
    - DD. Achene-tails glabrous to long silky-pubescent, but not plumose.
      - E. Leaves usually pinnate; leaflets 4-10 cm. long; sepals usually ovate, without a margin to moderately margined.....9. *C. Pitcheri*
      - EE. Leaves usually pinnate-ternate; leaflets mostly 4 cm. long or less; sepals lanceolate, moderately margined.....9a. *C. Pitcheri* var. *flifera*
  - CC. Leaves not conspicuously reticulate-veined.
    - D. Sepals with wide, undulate or crisped margins; achene-tails pubescent, not plumose.....10. *C. crispa*
    - DD. Sepals without a margin or narrow-margined; achene-tails plumose.
      - E. Flowers small, less than 15 mm. long; leaves pinnate, the larger leaflets 5-8 cm. long, densely soft-pubescent below.....2. *C. Gattingeri*
      - EE. Flowers considerably larger; leaves pinnate to pinnate-ternate, leaflets larger.
        - F. Leaves pinnate; leaflets simple, entire, large, extremely thin, densely velvety-pubescent below.....1a. *C. Viorna* var. *flaccida*
      - FF. Leaves pinnate to pinnate-ternate; leaflets not extremely thin nor densely pubescent below.....1. *C. Viorna*
- AA. Plants erect, not climbing.
  - B. All the leaves simple and broad, entire or rarely coarsely toothed.
    - C. Leaves glaucous.....3. *C. Addisonii*
    - CC. Leaves not glaucous.
      - D. Plants stout; achene-tails glabrous or nearly so.
        - E. Plants 1.5-4.0 dm. high; leaves ovate to obicular.....14. *C. Fremontii*
        - EE. Plants 2.5-7.0 dm. high; leaves elliptic-lanceolate to elliptic-ovate.....14a. *C. Fremontii* var. *Rieblii*
      - DD. Plants more slender; achene-tails conspicuously plumose.
        - E. Plants profusely branched; leaves lanceolate, less than 6 cm. long; sepals glabrous; achene-tails reddish-brown.....13. *C. viticaulis*
        - EE. Plants less branched; leaves ovate, at least some of them more than 6 cm. long; sepals pubescent; achene-tails usually lighter in color.
          - F. Plants simple or few-branched, more or less pubescent, achene-tails light yellowish-brown to tawny.....11. *C. ochroleuca*
          - FF. Plants usually much branched, often white silky-pubescent throughout; achene-tails whitish or pale yellow.....12. *C. albicoma*
  - BB. Leaves variously lobed, divided, pinnate, pinnatifid, or, if simple, distinctly linear or narrowly lanceolate.
    - C. Achene-tails glabrous or pubescent, not plumose.....18. *C. Bigelovii*
    - CC. Achene-tails plumose.
      - D. Plants extremely slender, glabrous or slightly pubescent; restricted to peninsular Florida.....15. *C. Baldwinii*
      - DD. Plants somewhat more stout, densely pubescent, at least in youth; native to the western states.
        - E. Leaves pinnate, the leaflets simple or lobed, lanceolate, distinctly petioluled.....16a. *C. birsutissima* var. *Scottii*
        - EE. Leaves, at least some of them, pinnate-ternate, 2-3-pinnatifid, or multifid, the leaflets various.

- F. Leaves mostly pinnate-ternate, the leaflets lobed or coarsely toothed, ovate, 3-7 cm. long. \_\_\_\_\_ 17. *C. Palmeri*  
 FF. Leaves 2-3-pinnatifid or multifid, slightly pubescent to densely hirsute, ultimate divisions narrow.  
 G. Ultimate divisions of the leaves linear, at least 2 mm. broad. \_\_\_\_\_ 16. *C. hirsutissima*  
 GG. Ultimate divisions of the leaves filiform, about 1 mm. broad. \_\_\_\_\_ 16b. *C. hirsutissima* var. *arizonica*

#### Subsection 1. EUVIORNAE

Somewhat woody vines (except *C. Addisonii*, which is bushy.) Leaves pinnate or pinnate-ternate, terminating in a tendril-like filament; petiolules and leaf-rachises twining. Flowers borne on 1-few-flowered axillary peduncles, nodding, more or less ovoid. Sepals thick, erect, connivent for most of their length, margins lacking or narrowly expanded toward the tips. Achene-bodies relatively large, strongly compressed, with prominent rims. Achene-tails plumose (in *C. Pitcheri* naked or merely pubescent.) Spp. 1-9a.

1. *Clematis Viorna* L. Sp. Pl. 543. 1753; Gray in Bot. Mag. *pl.* 6594. 1881; James in Jour. Cincin. Soc. Nat. Hist. 6:121. 1883; Kuntze in Verh. Bot. Ver. Brandenb. 26:133. 1885, in part; Gray, Syn. Fl. N. Am. 1:5. 1895; Britt. & Br. Ill. Fl. 2:69. 1897; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908.

*Viorna urnigera* Spach, Hist. Nat. Vég. Phan. 7:270. 1839.

*C. Viorna* γ. *normalis* Kuntze in Verh. Bot. Ver. Brandenb. 26:133. 1885.

V. *Viorna* Small, Fl. Southeast. U. S. 439, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:124, 1913; Small, Man. Southeast. Fl. 528. 1933.

V. *Ridgwayi* Standl. in Smithson. Misc. Coll. 56<sup>34</sup>:2, *pl.* 1. 1912; Britt. & Br. Ill. Fl., ed. 2. 2:124. 1913.

Stem slender, 6-angled, pilose at least below the nodes; cauline leaves pinnate with 3-4 pairs of divisions, the terminal pair usually minute, leaves ending in a slender tendril-like filament; leaf-divisions simple, 3-lobed or 3-foliolate, with petiolules one-third to one-half their length; leaflets ovate, acute to acuminate, entire, thin, indistinctly 3-5-veined, not reticulate-veined, more or less pilose below; peduncles axillary, 1-7-flowered; floral leaves simple or rarely 3-lobed, subsessile, approximating the cauline leaflets in size and character; flowers nodding, more or less ovoid, 1.5-2.5 cm. or less in length; sepals ovate, usually with slender terete woolly tips which are convolute in the bud, equalling or slightly exceeding the stamens, thick, smooth, short appressed-pubescent, margins white-tomentose, not expanded; peduncles in fruit erect; achene-bodies suborbicular to elliptic, 3-6 mm. broad, conspicuously rimmed, closely appressed-pubescent; achene-tails plumose, light yellow or brownish, spreading or loosely coiled.

DISTRIBUTION: on wooded river banks and in similar habitats, in the Piedmont and mountain regions from southern Pennsylvania to northern Mississippi, and from Ohio west to southern Missouri.

PENNSYLVANIA.—CHESTER CO.: Landenberg, 25 May 1930 & 18 June 1931, Stone (PA). FRANKLIN CO.: Mercersburg, 1850, Porter (G). LANCASTER CO.: Conestoga,

June 1887, and Mountville, July 1889, *Eby* (MBG); Conestoga Creek, July 1890, *Eby* (US).

DELAWARE.—NEW CASTLE CO.: Aug. 1863, *Canby* (FM); Mill Creek, 11 July 1896, *Canby* (US), and 17 July 1897 (PA); Pike Creek, Aug. 1902, *Canby* (G); Mt. Cuba, 10 July 1871, *Commons* (NY, PA, US), 14 July 1871 (G, MBG), and 2 July 1873 (PA); Mill Creek, *Commons* 6 (UM), and Long 28285 (PA); Wilmington, *Tatnall* (NY), Red Clay Creek, 2 July 1927 (UP), and Ashland, 1856 (G); Mt. Cuba, 24 June 1906, *Van Pelt* (PA); Ashland, 29 June 1924, *Williams* (G, NY, PA); Mt. Cuba, 24 June 1906, *Williamson* (NY).

MARYLAND.—CECIL CO.: Leslie Station, 28 June 1891, *Brinton* (UP), and 20 June 1892, *Crawford* (PA). HARFORD CO.: Broad Creek, *Tidestrom* 7190 (DU). MONTGOMERY CO.: s. e. of Great Falls, *Chase* 2311 (FM); Great Falls, *Hermann* 10380 (MBG, NY); Glen Echo, *House* 820 (MBG), and Plummers Island, 1089 (NY); Cabin John, *Smith* 3071 (G); canal opposite Great Falls, *Van Eseltine & Moseley* 107 (US); island at Great Falls, 29 May 1909, *Williamson* (PA). WASHINGTON CO.: n. w. of Sandy Hook, 5 June 1934, *Wherry* (UP). WORCESTER CO.: Snow Hill, *Moldenke* 4192 (NY).

DISTRICT OF COLUMBIA.—*Canby* (NY); 19 June 1877, *Chickering* (UM); May 1896, *Morris* (UM); Chain Bridge, *Pennell* 2481 (PA); 5 & 27 June 1896, *Steele* (MBG), and 27 June & 16 July 1897 (G, UM); 3 June 1877 & 17 July 1881, *Ward* (G).

VIRGINIA.—ALBEMARLE CO.: Woodridge, *Tidestrom* 7203 (US). ARLINGTON CO.: Ft. Meyer, 10 June 1893, *Blodgett* (NY); Chain Bridge to Cabin John Bridge, *Morris* 116 (FM); Potomac River, *Zumbrock* (FM). AUGUSTA CO.: Waynesboro, *Pursb* (PA). BEDFORD CO.: 1 July & 10 Aug. 1868, *Curtiss* (FM); 1 July 1871 (G, MBG, NY), and 1 July & 12 Aug. 1872 (FM, ND); Peaks of Otter, *Palmer* 38, 38a (US), and *Rydberg* 9236 (NY, PA). DINWIDDIE CO.: Petersburg, *Fernald & Long* 12078 (G), and Apr. 1903, *Prior* (US). FAIRFAX CO.: Great Falls, 14 July 1874, *Carter* (PA), *Pennell* 2507 (PA), *Seamans* (NY), and *Wismer* 520 (DU, UP). FREDERICK CO.: Middletown, *Griscom & Hunnewell* 18829 (G). GILES CO.: Narrows, 28 Aug. 1933, *Alexander, Everett & Pearson* (NY); Eggleston, *Biltmore Herb.* 317g (US), 4 June, 1890, *Brown et al.* (NY), *Fogg* 13361 (UP), and 14656 (MBG); Peters Mtn., *Fogg* 15038 (G, UP). GRAYSON CO.: Independence, *Gleason* 8759 (NY). GREENSVILLE CO.: Belfield, *Heller* 1003 (NY, PA, US). LOUDON CO.: Harper's Ferry, 18 July 1872, *Tenbrook* (PA). PAGE CO.: Powells, *Allard* 3199 (G); Kimball, 15 July 1917, *Miller* (US). PRINCE GEORGE CO.: by James River, *Fernald & Long* 8712 (FM, G), 9321 (G). ROANOKE CO.: Roanoke River, 5 June 1890, *Brown et al.* (NY). ROCKBRIDGE CO.: Glasgow, 29 May 1909, *Bartram* (G, PA); Lexington, 23 Aug. 1924, *Churchill* (MBG). ROCKINGHAM CO.: Mt. Crawford, *Heller & Halbach* 1003 (FM, G, MBG, UM). SMYTH CO.: Marion, 22 May 1892, *Britton, Britton & Vail* (PA), and 10 June 1892 (NY); White Rock Mtn., 22 June 1892, *Britton, Britton & Vail* (NY); Marion, 10 June 1892, *Small* (FM, MBG, UP, US), 29 June 1892 (FM), and 6 July 1892 (MBG, UM, US); White Mtn., 21 June 1892, *Small* (FM); falls of Holston River, 9 July 1892, *Small* (G). SOUTHAMPTON CO.: Carey Bridge, *Fernald & Long* 10265, 10266 (G). STAFFORD CO.: Falmouth, 20 Aug. 1891, *Porter* (NY, PA). SURRY CO.: Claremont Wharf, *Fernald & Long* 8268 (G).

NORTH CAROLINA.—ALEXANDER CO.: 10 mi. n. of Taylorsville, *Keever* 346 (DU). BLADEN CO.: e. of Elizabethtown, *Heller* 14044 (MBG, UM). BUNCOMBE CO.: Asheville, Aug.-Oct. 1933, *Alexander, Everett & Pearson* (NY); Biltmore, *Biltmore Herb.* 317 (MBG, UM, US), 317b (FM, G, MBG, NY, UM, UP, US); Bald Knob Mtn., *Correll* 115 (DU); Asheville, June 1925, *Kraus* (MBG); Montreat, *Standley & Bollman* 10380 (US). CALDWELL CO.: Blowing Rock Mtn., 16 Aug. 1891, *Small & Heller* (FM), and Rip Shin Mtn., 343 (NY). CHATHAM CO.: Bear Creek, *Correll* 636 (DU). CLAY CO.: Hayesville, *Huger* 36 (NY). DURHAM CO.: Duke Forest, *Blomquist* 6488 (DU), and *Oosting* 33137 (DU); s. w. of Durham, *Wiegand & Manning* 1207 (FM, G). FORSYTHE CO.: *Denke* 1145 (DU). GUILFORD CO.: Biltmore Herb. 317e (US); High Point, June 1868, *Canby* (NY). HALIFAX CO.: Lake Brantley, *Williamson* (FM); Welton, 21 May 1894, *Williamson* (PA), and July 1895 (NY). HAYWOOD CO.: Mt. Pisgah, *Blomquist* 3640 (DU); Pigeon River, 21 June 1934, *Oosting* (FM, PA); Crabtree Bald,

Pew 98 (FLA); Waynesville, *Standley* 5439, 5679 (US). HENDERSON CO.: n. of Hendersonville, *Caughey* 675 (DU); Bearwallow Mtn., *Peattie* 870 (FM). IREDELL CO.: Statesville, 7 June 1879, *Gray et al.* (PA), *Hyams* (UM), *Redfield* 11670 (MBG). JACKSON CO.: Balsam, July, *Williamson* (FM). LINCOLN CO.: Lincolnton, *Curtiss* (NY). MACON CO.: Highlands, *Biltmore Herb.* 317 (US); Whitesides Mtn., 11 July 1888, *Dunham* (FM), and *Oosting* 3634 (DU). MADISON CO.: Hot Springs, 1 June 1899, *Churchill* (MBG), and 3 June 1899 (G, MBG); Marshall, 18 June 1920, *Davis* (MBG, UM). MITCHELL CO.: Little Roan Mtn., *Harsbberger* 111 (UP); Roan Mtn., 14 Aug. 1892, *Merriam* (US), 19 July 1880, *Smith* (US). ORANGE CO.: Duke Forest, *Blomquist* 3639 (DU, UP); Couch Mtn., *Rodgers* 37 (MBG). POLK CO.: Lynn, 28 May 1899, *Churchill* (MBG); The Shoals, *Millsbaugh* 4103 (FM); Bearwallow Mtn., *Peattie* 868 (FM); Columbus, 15 June 1897, *Townsend* (US). RICHMOND CO.: Rockingham, *Biltmore Herb.* 317d (US). ROCKINGHAM CO.: Spray, *DeChalmot* (US); Benaja, *Wherry & Pennell* 14358 (MBG, PA). RUTHERFORD CO.: Chimney Rock, *Correll, Blomquist & Garren* 5137 (DU). STANLEY CO.: falls of Yadkin River, 18 Aug. 1891, *Small & Heller* (FM, US), and 23 Aug. 1894, *Small* (FM, MBG, NY, PA). SURRY CO.: Pilot Mtn., 4 July 1932, *Schallert* (ND). SWAIN CO.: 10 July 1891, *Beardslee & Kosoid* (G, MBG, UM). TRANSYLVANIA CO.: Pisgah Ridge, *House* 4347 (US); between Mt. Pisgah and Brevard, *Oosting* 34692 (DU); Pisgah Forest, *Rydberg* 9535 (NY). UNION CO.: Clifford, 11 July 1898, *Horsford* (G, US). WAKE CO.: 8 mi. n. w. of Raleigh, *Godfrey* 3979 (G), and 4 mi. s. w. of Raleigh, 5004 (DU, G). WATAUGA CO.: Blowing Rock, 15 July 1889, *Carter* (UP), and 15 June 1899, *Churchill* (G, MBG); 5 mi. w. of Blowing Rock, *Small & Heller* 343 (MBG, NY, PA, UM, US); Grandfather Mtn., *Small & Heller* 343 (DU, FLA, FM, NY, PA, UP, US). COUNTY NOT DETERMINED: July 1841, *Gray & Carey* (G, NY).

SOUTH CAROLINA.—AIKEN CO.: Graniteville, 21 May 1899, *Eggert* (MBG). LANCASTER CO.: 2 mi. w. of Taxahaw, *Huntley* 287 (DU). OCONEE CO.: Keowee, *House* 2172 (US); Newry, *House* 2220 (US). ORANGEBURG CO.: Ferguson, *Godfrey & Tryon* 806 (DU, G, MBG, NY, UP). RICHLAND CO.: Columbia, May 1890, *Taylor* (FM), and June 1891 (UM).

GEORGIA.—BARTOW CO.: Cartersville, *Biltmore Herb.* 317c (US). CATOOSA CO.: Ringgold, 6-12 Aug. 1895, *Small* (FM). DOUGHERTY CO.: Albany, *Pollard & Maxon* 522 (G, NY, US); Albany, 9-12 July 1895, *Small* (FM). GWINNETT CO.: McGuire's Mill, 9 Sept. 1894, *Small* (FM). HART CO.: Hartwell, *Wiegand & Manning* 1208 (G). RICHMOND CO.: Augusta, *Cuthbert* 681 (FLA, NY). SUMTER CO.: Flint River, *Harper* 1059 (NY).

ALABAMA.—AUTAUGA CO.: Prattville, *Smith* (US). DEKALB CO.: Collinsville, 29 June 1897, *Eggert* (MBG). ELMORE CO.: Tallapoosa River, Aug. 1899, *Earle* (NY). FRANKLIN CO.: Russellville, 1892, *Mohr* (US).

MISSISSIPPI.—CLARKE CO.: Shubuta, 10 Oct. 1896, *Schubert* (US).

OHIO.—HAMILTON CO.: w. of Cincinnati, 1 July 1863, *Bodley* (PA); Cincinnati, *Buchanan* (PA), 20 June, *Lee* (PA), 4 July 1881, *Lloyd* (PA), 20 July 1886 (UP), and 25 June 1890 (MBG). MUSKINGUM CO.: Zanesville, *Sargent* (PA). SCIOTO CO.: Camp Gordon, *Demaree* 10714 (G, MBG). WASHINGTON CO.: Rockland, *Biltmore Herb.* 317i (US).

WEST VIRGINIA.—FAYETTE CO.: New River, 21 July 1880, *Porter* (PA). HAMPSHIRE CO.: Hanging Rock, *Frye* 805 (PA). LINCOLN CO.: Miller School, 3 July 1929, *W. Va. U. Bot. Exp.* (G). MINGO CO.: Varney School, *Berkley* 970 (MBG). MONONGALIA CO.: Morgantown, *Eby* (MBG); Little Falls, *Millsbaugh* 864 (NY). PENDLETON CO.: Hermit Island, 3 July 1937, *Burton* (UP). WAYNE CO.: Buffalo Creek, *Plymale* 613 (DU, FM, G, MBG, NY, PA, UM). WOOD CO.: Kenhawa River, June 1838, *Buckley* (MBG). COUNTY NOT DETERMINED: Ganley Bridge, *Biltmore Herb.* 317b (US).

INDIANA.—CLARK CO.: Deam 7568 (NY); 5 mi. s. w. of Borden, *Deam* 18943 (UM); n. w. of Henryville, *Deam* 38914 (UM). JEFFERSON CO.: Hanover, July 1876, *Young* (NY). LAWRENCE CO.: w. of Bedford, *Kriebel* 659 (DU). MARION CO.: Bridgeport,

*Deam* 20542 (NY). MARTIN CO.: 1 mi. above Shoals, *Deam* 11402 (US), and 1 mi. w. of Huron, 17210 (G, UM). MONTGOMERY CO.: Crawfordsville, June 1889, *Seaton* (FM). WELLS CO.: Wabash River, 15 July 1897, *Deam* (FM, UM), Harrison Twp., Sec. 3, 17 (MBG, US), and e. of Bluffton, 5203 (NY).

ILLINOIS.—RICHLAND CO.: "Bird Haven", 2.5 mi. n. of Olney, 6 June 1910, *Ridgway* (US).

KENTUCKY.—BOYD CO.: *Smith et al.* 3597 (G, NY, US). FAYETTE CO.: Lexington, June 1835, *Peter* (PA). HARLAN CO.: Big Black Mtn., *Camp* 1514 (NY). JEFFERSON CO.: Louisville, May 1889, *Mueller* (DU, UM). MCCREARY CO.: Cumberland Falls, *Leeds* 2111 (PA). MERCER CO.: Burgin, *King* 90 (FM). WAYNE CO.: s. w. of Monticello, *Smith & Hodgdon* 3866 (G, US). WHITLEY CO.: n. e. of Jellico, *Smith & Hodgdon* 3818 (FM, G, PA, US). COUNTY NOT DETERMINED: Kentucky River, May 1833, *Peter* (NY); 1840, *Short* (NY), and 1842 (PA).

TENNESSEE.—BLOUNT CO.: Kinzel Springs, 18 June 1931, *Jennison* (US); 2.5 mi. s. of Walland, 9 June 1934, *Wherry* (UP). CHEATHAM CO.: w. of Pegram, *Svenson* 9605 (NY, PA). FENTRESS CO.: Wolf Creek, June 1896, *Ruth* (MBG). GRAINGER CO.: Bean's Station, 13 Aug. 1880, *Smith* (US). KNOX CO.: Knoxville, *Ruth* 374 (G), 776 (MBG), 1756 (NY).

MISSOURI.—BOLLINGER CO.: 5 mi. w. of Grassy, *Steyermark* 14103 (MBG). IRON CO.: Des Arc, *Smith* 1086 (FM). WAYNE CO.: 1 mi. e. of Greenville, *Steyermark* 11276, and w. of Greenville, 11578 (MBG). COUNTY NOT DETERMINED: Grand River, *Meehan* (UP).

STATE NOT DETERMINED.—*LeConte* (PA); Potomac Valley, June, *McCarthy* (FM); 15 July 1863, *Wister* (PA).

### 1a. *Clematis Viorna* var. *flaccida* (Small) Erickson, n. comb.

*C. flaccida* Small ex Britt. Man. 421. 1901.

*Viorna flaccida* Small, Fl. Southeast. U. S. 438, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:124. 1913; Small, Man. Southeast. Fl. 528. 1933.

*Clematis Viorna* Gray, Man. ed. 7, 403. 1908, in part.

Leaves pinnate, with 4 pairs of leaflets; leaflets simple or rarely 2-3-lobed, ovate-lanceolate, acute and apiculate, the lowermost 7-10 cm. long, very thin, velvety-pubescent beneath; sepals lavender at base, greenish toward tip; otherwise as in the species.

DISTRIBUTION: endemic in Warren Co., Kentucky.

KENTUCKY.—WARREN CO.: Bowling Green, 27 June 1897, *Price* (FM), May 1899 (NY TYPE), 10 June 1899, 16 June 1900, 8 July 1901 (MBG).

The leaf variation in *C. Viorna* is considerable, but the large, thin, pubescent, simple leaflets of this variety are quite distinct from those of the species proper.

### 2. *Clematis Gattingeri* Small in Bull. Torr. Bot. Club 24:209. 1897.

*Viorna Gattingeri* Small, Fl. Southeast. U. S. 438, 1330. 1903; Small, Man. Southeast. Fl. 527. 1933.

Stem slender, angled, densely puberulent; cauline leaves pinnate, with 3-4 pairs of leaflets, rachis and petiolules puberulent, terminating in a tendril-like filament; leaflets lanceolate or broadly lanceolate, simple, entire, acute-tipped, the lower ones 5-8 cm. long, thin and membranous, densely soft-pubescent below, sparsely pubescent above; peduncles short, axillary, 1-3-flowered; floral leaves simple, 5-15 mm. long, short-petioled; flowers purple, 10-13 mm. long, campanulate; sepals

elliptic or elliptic-lanceolate, acuminate, minutely pubescent without, narrowly margined above the middle; achene-bodies ovate-elliptic to suborbicular, 4-6 mm. broad, short appressed-pubescent; achene-tails 1.5-3.0 cm. long, plumose, light brown.

DISTRIBUTION: central Tennessee.

TENNESSEE.—DAVIDSON CO.: Nashville, June 1878, *Gattinger* (MBG, NY TYPE), July 1897 (NY, US), June 1898 (NY), above Nashville, June 1897 (MBG); Nashville, July 1897, *Williamson* (PA). FRANKLIN CO.: Cumberland Mtn., 21 July 1897, *Egger* (MBG).

The glandular appearance of the stems, petioles and leaves of the *Gattinger* specimens, which Small emphasized in his description, is due, as Svenson<sup>21</sup> has pointed out, to dust accumulation on the hairs of these organs. This glandular appearance is not evident on the other specimens cited here, and furthermore they lack flowers. However, they agree with the *Gattinger* specimens in leaf and other characters.

3. *Clematis Addisonii* Britt. ex Vail in Mem. Torr. Bot. Club 2:28, *foot-note* & pl. 3. 1890; Robins. ex Gray, Syn. Fl. N. Am. 1:5. 1895; Britt. & Br. Ill. Fl. 2:69. 1897, in part; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908.

*C. viornoides* Britt. ex Britt. & Br. Ill. Fl. 2:69. 1897; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908; Britt. & Br. Ill. Fl. ed. 2, 2:123. 1913.

*Viorna Addisonii* Small, Fl. Southeast. U. S. 439, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:123. 1913; Small, Man. Southeast. Fl. 528. 1933.

*C. ovata* Torr. & Gray, Fl. N. Am. 1:8. 1838, probably; not Pursh, Fl. Am. Sept. 2:736. 1814.

Erect or ascending, usually much branched and bushy; stems slender, terete or obscurely ribbed, glabrous and glaucous; lower cauline leaves and floral leaves simple, 2-13 cm. long, sessile or subsessile, broadly ovate, obtuse or round-tipped, mucronate, entire, glabrous, conspicuously glaucous below, thin and inconspicuously veined; upper cauline leaves pinnate, or in small plants all the leaves simple; leaflets 2, rarely 3, pairs, more or less oblique at the base, otherwise simulating the simple leaves in all respects, basal pair usually several times as long as the terminal pair, petiole short, rachis long and slender, terminating in a tendril-like filament; flowers solitary at the ends of branches or on axillary peduncles, 1-2 cm. long, ovoid; sepals equalling or slightly exceeding the stamens, narrowly ovate, tips acute and sharply recurved, red- or blue-purple, glabrous without, margins unexpanded, tomentose; pedicels in fruit scarcely exceeding the foliage; achene-bodies orbicular to quadrangular, about 6 mm. broad, strongly compressed, broad-rimmed, finely short-pubescent; achene-tails 2.5-3.5 cm. long, plumose, yellow or tawny.

DISTRIBUTION: wooded river banks, in a restricted region of the Blue Ridge in Virginia.

VIRGINIA.—BOTETOURT CO.: Buchanan, 22 May 1881, *Churchill* (MBG). MONTGOMERY CO.: 5 mi. n. of Christiansburg, 12 Oct. 1936, *Alexander* & *Creban* (NY); 3.5 mi. w. of Shawsville, *Massey* 2017 (G), and s. of Fagg, 3853 (G); 3.5 mi. w.s.w. of

<sup>21</sup> Svenson, Jour. Tenn. Acad. Sci. 16:130. 1941.

Shawsville, 15 July 1936, *Wherry* (UP), and s. of Fagg, 15 June 1939 (UP). ROANOKE CO.: Roanoke, 16 May 1892, *Britton & Vail* (FM, US); Roanoke, 29 May 1890, *Brown et al.* (NY TYPE), 30 May-9 June 1890 (MBG, NY, PA, US), and May 1891, *Brown* (G); s. of Roanoke, *Small & Heller* 219 (FM, MBG, UP, US); above Natural Bridge Station, 30 May 1909, *Bartram* (G, NY, PA); Glasgow, 3 June 1891, *Churchill* (G, MBG).

This species is unique in having both simple and compound cauline leaves. It resembles most nearly *C. glaucophylla*, but is clearly distinguished from the latter by the peculiar appearance of its few-foliate compound leaves.

4. *Clematis glaucophylla* Small in Bull. Torr. Bot. Club 24:337. 1897; Britt. Man. 422. 1901.

*Viorna glaucophylla* Small, Fl. Southeast. U. S. 439, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:124. 1913; Small, Man. Southeast. Fl. 528. 1933.

*C. Viorna* Gray, Man., ed. 7, 403. 1908, in part.

*C. Addisonii* Gray, l. c., in part.

Stem rather slender, ribbed, glabrous; cauline leaves with 4-5 pairs of leaflets, rachis somewhat geniculate, terminating in a slender filiform appendage or minute leaflet; leaflets, at least the basal ones, usually deeply 3-lobed or 3-foliate, but also simple, ovate, acute- to obtuse-tipped, base cordate or subcordate, basal leaflets 3-7 cm. long, thickish, with a few prominent veins, but not reticulate, glabrous on both surfaces, glaucous below; peduncles axillary, 1-3-flowered, floral leaves simple, sometimes small, sometimes larger than the cauline leaflets, approximating the latter in shape and character, but with a short petiole; flowers ovoid, 2.0-2.5 cm. long, reddish-purple; sepals ovate-lanceolate, spreading slightly at the tip, glabrous, margins unexpanded, white-tomentose; achene-bodies suborbicular, inequilateral, 2-6 mm. broad, with a moderately wide rim; achene-tails 6 cm. long, plumose, tawny, loosely intertwined or spreading.

DISTRIBUTION: in rich woods or along streams, from Virginia south to Florida and west to Arkansas; one specimen from Oklahoma.

VIRGINIA.—GILES CO.: Peter's Mtn., *Schub* 109, 118 (NY).

NORTH CAROLINA.—BUNCOMBE CO.: The Pinnacle, *Rydberg* 9435 (NY). MURRAY CO.: n. of Mt. Airy, 20 June 1909, *Rusby* (NY).

SOUTH CAROLINA.—ANDERSON CO.: 1885, *Gibbes* (NY). PICKENS CO.: Six-mile Creek, *House* 3382 (NY).

GEORGIA.—CATOOSA CO.: Ringgold, 6-12 Aug. 1895, *Small* (NY). DOUGHERTY CO.: Albany, 9-12 July 1895, *Small* (NY). GWINNETT CO.: McGuire's Mill, 11 July 1893, *Small* (FM, NY TYPE), 9 Sept. 1894 (NY), and 2 July 1895 (NY, UM); Yellow River store, 20 July 1893, *Small* (G, MBG, NY, US). WALKER CO.: Chickamauga, 27 May 1913, *Churchill* (G, MBG); Chickamauga Park, May 1898, *Tidestrom* (ND). COUNTY NOT DETERMINED: *LeConte* (PA); *Turner* (PA).

FLORIDA.—GADSDEN CO.: Chattahoochee River, *Busb* 365 (NY, US); Victory Bridge, 14 Mar. 1937, *Expl. Party*, and 19 Aug. 1940, *Hocking* (FLA). JACKSON CO.: n. of Marianna, 17 Mar. 1937, *Expl. Party* (FLA); Marianna, 7 Aug. 1935, *Small & West* (FLA).

ALABAMA.—MARSHALL CO.: Guntersville, *Howell* 816 (US). TALLAPOOSA CO.: 23 June 1897, *Earle & Baker* (MBG, NY, UM).

KENTUCKY.—BARREN CO.: Glasgow Junction, 21 May 1898, *Price* (PA), 21 May 1899 (MBG), and 26 & 27 May 1899 (MBG, NY). EDMONSON CO.: Mammoth Cave,

May 1899, *Palmer* (G, NY, US). ESTILL CO.: *Irvine, Anderson* 92 (G). KNOX CO.: *Barbourville*, 9 July 1888, *Lloyd* (NY). ROCKCASTLE CO.: n. of *Livingston, Smith & Hodgdon* 3777 (G, NY, US). WARREN CO.: *Bowling Green*, June 1892, *Price* (MBG).

TENNESSEE.—CHEATHAM CO.: *Craggie Hope, Pennell* 11458 (PA); *Kingston Springs, Svenson* 15 (G), and *Pegram*, 10325 (PA). DAVIDSON CO.: 5 mi. above *Nashville*, June-July 1897, *Gattinger* (MBG, NY, US); *Nashville, Pennell* 11412 (PA); *Radnor Lake, Svenson* 64 (G). FRANKLIN CO.: *Sewanee*, 1897, *Cutbber* (FLA); *Cowan*, July 1898, *Ruth* (MBG), 205 (US), 208 (NY), 372 (G). KNOX CO.: *Knoxville*, 1893, *Ruth* (MBG).

ARKANSAS.—GARLAND CO.: *Hot Springs, Scully* 312 (G). SEVIER CO.: *Horatio, Brinkley* 97 (FM).

OKLAHOMA.—MC CURTAIN CO.: *Shawneetown, Houghton* 3872 (G, MBG, NY).

*C. Addisonii* is closest to this species. Its other relationships appear to be with *C. Viorna*, on the one hand, which it closely resembles in leaf characters, and with which it may be found to intergrade; and on the other hand, with *C. texensis* and *C. versicolor*. With the latter two species it shares a very similar flower structure and glaucous leaves; it differs from them in the degree of reticulation of the leaves.

5. *Clematis versicolor* Small ex Britt. Man. 421. 1901; Gray, Man. ed. 7, 403. 1908.

*Viorna versicolor* Small, Fl. Southeast. U. S. 438, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:124. 1913.

*C. troutbeckiana* Spingarn in Gard. Chron. III, 94:310. 1933; and in Nat. Hort. Mag. 13:88. 1934.

A slender vine, simple or little branched; stems ribbed, glabrous, glaucous; cauline leaves with 4 pairs of leaflets, rachis slender, geniculate, terminating in a tendril-like filament; leaflets simple or rarely 2-3-lobed, ovate, base obtuse to subcordate, tip acute to rounded, not emarginate, mucronate, the basal leaflets 3-7 cm. long, with slender petiolules, glabrous, glaucescent above, glaucous below, reticulate; peduncles axillary, 3-7-flowered, the lowest pair of floral leaves similar in shape and character to the cauline leaflets but smaller and short-petioled; flowers subglobose, 1.5-2.5 cm. long, blue-lavender, fading to green toward the tips; sepals narrowly ovate, scarcely recurved at the tips, glabrous and glaucous, margins unexpanded, white-tomentose; achene-bodies orbicular and usually somewhat inequilateral, 5-6 mm. broad, moderately rimmed, closely appressed-pubescent; achene-tails 5-6 cm. long, plumose, pale yellow, rarely tawny, loosely intertwined or spreading.

DISTRIBUTION: barrens and stony woods of the Ozarks of southern Missouri and northern Arkansas; also in western Kentucky and Tennessee, southwestern Arkansas and southeastern Oklahoma.

KENTUCKY.—LOGAN CO.: 3 mi. w. of *Russellville, Gleason* 8937 (NY). TODD CO.: *June, Short* (PA).

TENNESSEE.—DAVIDSON CO.: *Nashville*, 1884, *Gattinger* (US); *Fort Donelson*, June 1863, *Greene* (ND); w. of *Nashville, Shaver & Svenson* 7359 (G, ND). HENDERSON CO.: w. of *Lexington, Pennell* 11491 (PA).

MISSOURI.—BARRY CO.: *Eagle Rock, Bush* 32 (MBG, UM, US), and 77 (G, MBG); 4.5 mi. s. w. of *Viola, Steyermark* 22533 (FM, MBG, NY). CHRISTIAN CO.: 3 mi. s. w. of *Chadwick, Steyermark* 23107 (FM, MBG). MC DONALD CO.: *Bush* 5 (G, NY TYPE),

and 24 July 1892 (MBG); Noel, *Bush* 5771 (MBG, PA), and 9 Aug. 1908, *Palmer* (MBG); Pineville, *Palmer* 39285 (MBG, US). OREGON CO.: s. of Thayer, *Pennell* 11591 (PA); 1 mi. n. of Greer, *Steyermark* 7075, 3 mi. n. w. of Greer 12132, and n. of Greer 14352 (MBG). OZARK CO.: Pontiac, *Palmer* 34782 (MBG); Hammond *Steyermark* 22802 (FM, MBG), and w. of Rockbridge 26931 (FM). STONE CO.: 1 mi. n. w. of Marmaros, *Steyermark* 22637 (MBG). TANEY CO.: Hollister, 20 Aug. 1939, *Moore* (FM); Branson, *Palmer* 5879 (US); 4 mi. s. of Ocie, *Steyermark* 5301 (FM, MBG), and Hickey Spring, 5547 (MBG).

ARKANSAS.—BENTON CO.: Irwin Mtn., *Demaree* 4567, Siloam Springs, 6603, Bentonville, 6773, and Sulphur Springs, 6846 (US); Decatur, 1899, *Plank* (NY). CARROLL CO.: Beaver, *Bush* 14828 (MBG); Eureka Springs, 8 May 1901, *Canby* (G), and 16 July 1898, *Glatfelter* (MBG); Beaver, *Palmer* 6352 (US); Eureka Springs, *Wislizenus* 694 (MBG). FAULKNER CO.: e. of Garfield, *Demaree* 6619 (US). IZARD CO.: Guion, *Pennell* 10684 (NY, PA). SEVIER CO.: Bog Springs, *Brinkley* 268 (FM). WASHINGTON CO.: Farmington, 17 May 1925, *Anderson* (MBG); Illinois River, *Engelmann* 163 (MBG); Wheeler, *Palmer* 27011 (MBG); Farmington, Aug. 1924, *Shreve* (NY).

OKLAHOMA.—PUSHMATAHA CO.: 6 mi. n. of Finley, *Pennell* 19378 (PA).

Although this species is very closely related to *C. texensis*, it can be readily distinguished by its flower color if living material is seen. In herbarium material the distinction may be made on the basis of its somewhat more slender habit and smaller size throughout, its less compound leaves and less pointed leaflet-tips. *C. versicolor* is a less variable species than *C. texensis*. Further study, particularly field study, of these two species is desirable, especially in the region between the Ozarks and the Edwards Plateau, to determine whether there are connecting forms between the two species as here understood. The writer has seen comparatively few specimens which are not from either the Edwards Plateau or the Ozarks. Those from southeastern Oklahoma and southwestern Arkansas have rather arbitrarily been assigned to *C. versicolor*, and those from northeastern Texas (Smith Co.) to *C. texensis*. Field study may change this interpretation. The specimens from Kentucky and Tennessee, also, suggest that intergradation between *C. glaucophylla* and *C. versicolor* may exist.

6. *Clematis texensis* Buckl. in Proc. Acad. Nat. Sci. Phila. 13:448. 1862.

*C. Viorna* var. *coccinea* Gray in Smiths. Contr. Knowl. 5<sup>6</sup> [Pl. Wright. 2]:7. 1853; James in Jour. Cincin. Soc. Nat. Hist. 6:119. 1883.

*C. coccinea* Engelm. ex Gray in Smiths. Contr. Knowl. 5<sup>6</sup> [Pl. Wright. 2]:7. 1853, as synonym; Gray in Bot. Mag. pl. 6594. 1881; Gray, Syn. Fl. N. Am. 1:6. 1895.

*C. texensis* var. *parviflora* Lavallée, Clem. 65. pl. 19. 1884.

*C. texensis* var. *typica* Lavallée, l. c.

*C. Viorna* δ. *coccinea* Kuntze in Verh. Bot. Ver. Brandenb. 26:133. 1885.

*C. Viorna* δ. *coccinea* 2. *parviflora* Kuntze, l. c.

*C. Viorna* δ. *coccinea* 3. *segreziensis* Kuntze, l. c. 134.

*C. coccinea* var. *major* Beissner ex Beissner, Schelle & Zabel, Handb. Laubh.-Benen. 108. 1903, *nomen nudum*.

*C. coccinea* var. *segreziensis* Beissner, l. c.

*C. coccinea* var. *parviflora* Beissner, l. c.

*Viorna coccinea* Small, Fl. Southeast. U. S. 438, 1331. 1903.

Stem slender, ribbed, glabrous, glaucous, especially near the nodes; cauline leaves with 4-5 pairs of leaflets, rachis slender, geniculate, terminated by a tendril-like filament; leaflets simple, 2-3-lobed or rarely 3-foliate, ovate to orbicular, bases rounded to cordate, tips obtuse, rounded or occasionally emarginate, usually with a small mucro, the basal ones 3-9 cm. long, long-petiolulate, glabrous on both surfaces, glaucous below, moderately to strongly reticulated; peduncles axillary, 1-7-flowered, the lowest pair of floral leaves approximating in size and character the cauline leaflets, but with a short petiole; flowers ovoid, 2-3 cm. long, scarlet; sepals ovate-lanceolate, recurved at the tip, glabrous, glaucous, margins scarcely expanded, white-tomentose; achene-bodies orbicular, essentially symmetrical, 6-7 mm. broad, prominently rimmed, closely appressed-pubescent; achene-tails plumose, tawny, 6-7 cm. long, loosely intertwined or spreading.

DISTRIBUTION: along streams and in woods, on the Edwards Plateau of Texas and extending into northeastern Texas.

TEXAS.—BEXAR CO.: Classen Ranch, Schulz 51 (US). BLANCO CO.: Blanco, Palmer 12170 (MBG), Wright (MBG, NY, US). COMAL CO.: New Braunfels, Lindheimer 383 (G, MBG), 624 (PA, UP), 625, 627, 655 (MBG), 656 (MBG, NY, PA, TEX, US), 657 (MBG, NY, PA, US), 658 (MBG, NY, PA, TEX, UP, US);<sup>22</sup> New Braunfels, 17-19 April 1903, Pilsbry (PA). EDWARDS CO.: Frio water-hole, Hill 65, 66, 67 (US). GILLESPIE CO.: Sandy Creek, Jermy 230, and Threadgill, 627 (MBG, US). HAYS CO.: 2 Apr. 1881, Buckley (MBG, PA, US). KERR CO.: Kerrville, Heller 1607, 1608 (FM, G, MBG, UP, US), July 1889, Munson & Hopkins (US), and Palmer 2941 (MBG, US); 12 mi. s. w. of Kerrville, Parks & Cory 23459, 23460, 23461 (TAM); Kerrville, Pennell 10365 (PA); 7 June 1929, Whitehouse (TEX). LAMPASAS CO.: Lampasas River, Reverchon 1684 (MBG). LLANO CO.: Enchanted Rock, 11 June 1930, Tharp & Whitehouse (TEX). MEDINA CO.: Upper Seco, Reverchon 1484 (FM, MBG, NY, UP, US); Upper Hondo, Reverchon 1684 (MBG); Medina Dam, June 1924, Schulz (FM). SMITH CO.: Lindale, 23 April, Reverchon (MBG); e. of Swan, Reverchon 2962 (MBG). TRAVIS CO.: Austin, Bogusch 193 (US), Bray 120 (NY), Buckley (G, NY, PA, US); above Austin, May 1860, Buckley (PA TYPE); Bull Creek, 20 Apr. 1901, Ferguson (TEX); Austin, 3 May 1930, Tharp (TEX), and York 409 (MBG); Bull Creek, 11 Apr. 1914, Young (MBG), and Austin, 22 (TEX). UVALDE CO.: Montell Creek, Parks & Cory 13942 (TAM). COUNTY NOT DETERMINED: April 1848, Lindheimer (MBG), 57 (MBG); May 1885, Reverchon (G); Rio Grande, 1848, Wright (G).

7. *Clematis reticulata* Walt. Fl. Carol. 156. 1788; James in Jour. Cincin. Soc. Nat. Hist. 6:123. 1883; Gray, Syn. Fl. N. Am. 1:6. 1895.

*C. Viorna*  $\beta$ . *reticulata* Kuntze in Verh. Bot. Ver. Brandenb. 26:133. 1885, in part.

*C. Viorna*  $\beta$ . *reticulata* 3. *flavida* Kuntze, l. c., probably.

*Viorna reticulata* Small, Fl. Southeast. U. S. 438, 1330. 1903; Small, Man. Southeast. Fl. 527. 1933.

*V. subreticulata* Harbison ex Small, Man. Southeast. Fl. 527, 1504. 1933.

*C. versicolor* f. *pubescens* Steyermark in Rhodora 40:71. 1938.

Stem slender, 6-angled, red, sparsely pubescent at the nodes; cauline leaves long-petioled, with 4 pairs of leaflets, rachis terminating in a tendril-like filament

<sup>22</sup> Several of the Lindheimer numbers listed here were assigned also to specimens of *C. Pilschii*.

or minute leaflet; leaflets entire or rarely 2-3-lobed, usually elliptical with a rounded and mucronate tip, but varying to ovate and acute-tipped, 2-6 cm. long or longer, long-petioluled, very strongly and closely reticulated on both the upper and lower surfaces; peduncles axillary, 1-3-flowered, floral leaves usually less than 4 cm. long, otherwise simulating the cauline leaflets; flowers nodding, 1.5-2.5 cm. long; sepals equalling or somewhat exceeding the stamens, densely covered with yellow canescent pubescence,<sup>23</sup> tips acute, recurved, margins narrowly expanded, tomentose; achene-bodies suborbicular, symmetrical, 4 mm. broad, with a prominent rim, appressed-pubescent; achene-tails 4-6 cm. long, plumose, pale yellow-brown, loosely intertwined.

DISTRIBUTION: in sandy soil in fields and thickets, South Carolina to Florida and west to Arkansas and Texas.

SOUTH CAROLINA.—AIKEN CO.: Aiken, 24 June 1901, *Cuthbert* (FLA), *Eggleston* 5062 (NY); Hamburg, 20 May 1835, *Gibbes* (NY). CHARLESTON CO.: Charleston, *Backman* (PA). RICHLAND CO.: 6 mi. s. of Columbia, 18 May 1936, *Phelson* (DU). COUNTY NOT DETERMINED: June 1888, *McCarthy* (US).

GEORGIA.—COFFEE CO.: Seventeen-mile Creek, *Harper* 1463 (FM, G, MBG, NY, US). MARION CO.: w. of Buena Vista, *Harper* 1408 (G, MBG, NY, US). RICHMOND CO.: Augusta, *Cuthbert* 560 (NY). SCREVEN CO.: 13 July 1904, *Cuthbert* (FLA). STEWART CO.: Sanford, *Eaton* 1043 (FM, G). SUMTER CO.: summer 1897, *Harper* (MBG, NY); Americus, *Tracy* 3502 (MBG). COUNTY NOT DETERMINED: 1840, *Boykin* (PA).

FLORIDA.—ALACHUA CO.: Gainesville, 21 June 1931 and 22 May 1932, *Arnold* (FLA), 12 Apr. 1897, *Crawford* (PA), and June 1876, *Garber* (US); June-July 1898, *Hitchcock* (FM, MBG); Gainesville, 19 May 1940, *Murrill* (DU, MBG), w. of Gainesville, 28 May 1940 (MBG); Gainesville, 24 May 1927, *Weber & West* (FLA). BREVARD CO.: 2 mi. n. of Cocoa, 25 Sept. 1936, *Roads* (FLA). CLAY CO.: Green Cove Springs, *Biltmore Herb.* 1996a (US); Goldhead Branch State Park, 27 May 1939, *Murrill* (FLA). COLUMBIA CO.: Lake City, June-July 1898, *Hitchcock* (FM); Lake City, *Quaintance* 60 (FM, MBG), 16 May 1892, *Rolfs* (FLA), and 59 (FM); 1 mi. w. of Lake City, *Wiegand & Manning* 1204 (G). DUVAL CO.: St. Nicholas, 20 Apr. 1897, *Churchill* (G, MBG); Jacksonville, May 1893, *Curtiss* (MBG, UM), 9 (FM, G, MBG, NY, PA, UM, US), 4203 (MBG, NY, US), 4813 (G, NY, PA, UM, US), 6174 (FLA), and 9876 (MBG); Jacksonville, 28 May 1934, *Didell* (NY); *Fredholm* 106 (US), 5190 (G, MBG, US); St. Nicholas, *Lightbipe* 195 (MBG, NY, UM, US); Jacksonville, *Peters* 36 (US); 1 mi. n. of Tisonia, *Wiegand & Manning* 1202 (G); Jacksonville, Apr., *Williamson* (FM), and 11 July 1895 (PA). FRANKLIN CO.: Apalachicola, *Chapman Herb.* (MBG, NY). GADSDEN CO.: Mt. Vernon, July-Aug. 1843, *Rugel* (NY). GILCHRIST CO.: e. of Old Town, *Small, Small & DeWinkler* 11468 (G, NY). JEFFERSON CO.: June-July 1898, *Hitchcock* (MBG). LAKE CO.: Eustis, June-July 1894, *Hitchcock* (FM, MBG, NY); Lane Park, 22 June 1941, *Murrill* (FLA); Eustis, *Nash* 611 (FM, G, MBG, ND, NY, PA, UM, US), 1466 (PA), and 1890 (FM, MBG, NY, UM, US). LEON CO.: Sebring, Aug. 1935, *McFarlin* (NY). LEVY CO.: Rosewood, June 1876, *Garber* (FM, PA). MADISON CO.: June-July 1898, *Hitchcock* (FM). MANATEE CO.: Sarasota, collector unknown 7214 (NY). ORANGE CO.: Orlando, 26 Aug. 1929, *O'Neill* (FLA, US). PASCO CO.: Fivay, 4 July 1929, *O'Neill* (FLA, US), and St. Leo (FLA). POLK CO.: Carter's, *McFarlin* 4843 (TEX); Peace Creek, 2 Apr. 1880, *Smith* (US). PUTNAM CO.: Johnson, *Barnhart* 2135 (FM, US); Palatka Ravine Gardens, *Correll* 6402 (DU); Grandin, 25 June 1936, *Knight* (FLA); Crescent City, 11 Apr. 1882, *Mohr* (US). ST. JOHNS CO.: St. Augustine, April 1890, *MacElwee* (PA); St. Augustine, 1877, *Reynolds* (FM, NY, PA).

<sup>23</sup> In several specimens from the northern part of the range of this species, the sepals are nearly glabrous, resembling those of *C. glaucophylla*. They intergrade, however, with those plants having canescent sepals.

TAYLOR CO.: e. of Perry, *Small, Small & DeWinkeler* 11461 (NY). VOLUSIA CO.: 5 mi. s. of Daytona, *Small, Small & DeWinkeler* 10560 (NY). WALTON CO.: DeFuniak Springs, Tracy 9450 (G, MBG, NY). COUNTY NOT DETERMINED: Buckley (MBG, US); Chapman Herb. (MBG, PA, US); Croom 129 (NY); Macfarlane (UP); 1 May 1894, Price (MBG); Torrey Herb. (NY).

ALABAMA.—CONECUH CO.: Evergreen, 2 June 1897, Earle & Baker (MBG, NY, UM). CULLMAN CO.: Garden City, *Biltmore Herb.* 15011 (NY, US). DALE CO.: Ozark, *Biltmore Herb.* 1996b, 1996d (US), and Newton 1996c (US); Pea River, Palmer 27234 (MBG). ELMORE CO.: Tallapoosa River, Aug. 1899, Earle (NY). HENRY CO.: Abbeville, *Biltmore Herb.* 1996e (US); 8 mi. n. of Headland, Wiegand & Manning 1206 (G). JEFFERSON CO.: Shade's Mtn., Leeds 2133 (PA). MONTGOMERY CO.: Catoma Creek, 19 Aug. 1884, Smith (FM, G, US). PIKE CO.: Troy, 15 May 1925, Wherry (PA, UP). COUNTY NOT DETERMINED: Juggsville, 1882, Denny (US).

TENNESSEE.—DAVIDSON CO.: Nashville, June 1878, Gattinger (FM).

ARKANSAS.—SEVIER CO.: Bog Springs, Brinkley 268 (FM, G).

TEXAS.—CASS CO.: Queen City, 11 May 1925, Wherry (UP). CHEROKEE CO.: Chronister, 12 July 1912, White (TEX). HARDIN CO.: 7.5 mi. w. of Silsbee, Cory 11218 (G). HARRIS CO.: Harrisburg, 9 Aug. 1876, Joor (US), Lindheimer 5 (G). HAYS CO.: San Marcos, June 1894 & July 1897, Stanfield (NY). HOUSTON CO.: Grapeland, 8 June 1920, Tharp (TEX). MONTGOMERY CO.: Conroe, Fisher 3250 (FM). RED RIVER CO.: Burk (UP). SAN AUGUSTINE CO.: San Augustine, Crockett (US), and Palmer 10627a (MBG, US). TITUS CO.: Mt. Pleasant, Cross 5750 (US). TRAVIS CO.: Austin, Rugel (UP).

It seems best to unite *Viorna subreticulata* with this species. It is founded largely on the larger, somewhat thinner leaflets and lack of canescent pubescence on the outside of the sepals. The species as here understood varies considerably in these and other characters in the northeastern part of its range (e. g. Harper 1408 and Palmer 27234, in which the lower surfaces of the leaves are quite pubescent) and in Texas. In Florida, however, it is relatively constant.

#### 8. *Clematis Beadlei* (Small) Erickson, n. comb.

*Viorna Beadlei* Small, Man. Southeast. Fl. 527, 1504. 1933.

Stem slender, 6-angled, reddish-brown, glabrous, or slightly pubescent at the nodes; cauline leaves with 3-4 pairs of leaflets, rachis slender, finely pubescent, geniculate, terminating in a tendril-like appendage; leaflets ovate, acute or acuminate, simple and entire, or the basal ones commonly 2-3-lobed, 2.5-8.0 cm. long, thin and chartaceous, moderately and distantly reticulate; peduncles axillary, 1-flowered, floral leaves 2.5 cm. long, simple and entire, short-petioled; flowers not seen; fruiting heads 5 cm. in diameter; achene-bodies ovate, inequilateral, 4.5-5.5 mm. broad, moderately rimmed, not greatly compressed, long appressed-pubescent; achene-tails 5-6 cm. long, plumose, loosely intertwined.

DISTRIBUTION: in scattered localities from northern Georgia to Texas.

GEORGIA.—HABERSHAM CO.: Currahee Mtn., 1-3 Sept. 1894, Small (NY TYPE). HANCOCK CO.: Mayfield, 28 Apr. 1900, Cutbbert (FLA).

MISSISSIPPI.—LOWNDES CO.: Tombigee River, 5 June 1888, Mohr (US); Columbus, *Biltmore Herb.* 1996f (UM, US).

TENNESSEE.—WHITE CO.: Sparta, *Biltmore Herb.* H/2689 (US). COUNTY NOT DETERMINED: Warren, 30 July 1900, *Biltmore Herb.* (US).

ARKANSAS.—COUNTY NOT DETERMINED: Mt. Nebo, *Biltmore Herb.* 317j (UM, US).

TEXAS.—HARRIS CO.: 9 June 1926, Tharp 4371 (TEX).

This species is apparently closely related to *C. reticulata* but is clearly outside the range of variation of the latter.

9. *Clematis Pitcheri* T. & G. Fl. N. Am. 1:10. 1838; Gray in Bot. Mag. pl. 6594. 1881; Gray, Syn. Fl. N. Am. 1:6. 1895; Gray, Man. ed. 7, 403. 1908.  
*C. coloradoensis* Buckl. in Proc. Acad. Nat. Sci. Phila. 13:448. 1862.  
*C. Pitcheri* var. *leiostylis* Gray in Bot. Mag. pl. 6594. 1881; Gray, Syn. Fl. N. Am. 1:6. 1895.  
*C. Pitcheri* var. *lasiostylis* Gray in Bot. Mag. pl. 6594. 1881; Gray, Syn. Fl. N. Am. 1:6. 1895.  
*C. Viorna* var. *Pitcheri* James in Jour. Cincin. Soc. Nat. Hist. 6:121. 1883.  
*C. Sargentii* Lavallée, Clem. 60, pl. 18. 1884.  
*C. Viorna* β. *reticulata* Kuntze in Verh. Bot. Ver. Brandenb. 26:133. 1885, in part.  
*C. Viorna* β. *reticulata* 2. *membranacea* Kuntze, l. c., probably.  
*C. Viorna* β. *reticulata* 4. *Sargentii* Kuntze, l. c.  
*C. Viorna* β. *reticulata* 5. *obtusifoliola* Kuntze, l. c., probably.  
*C. Simsii* Kuntze, l. c. 134, in part; Britt. in Mem. Torr. Bot. Club 5:158. 1894; Britt. & Br. Ill. Fl. 2:68. 1897; Britt. Man. 421. 1901; not Sweet, Hort. Brit. ed. 1, 1. 1827.  
*C. Simsii* a. *Pitcheri* Kuntze, l. c. 135.  
*C. Simsii* a. *Pitcheri* 2. *micrantha* Kuntze, l. c.  
*C. Simsii* a. *Pitcheri* 3. *chrysocarpa* Kuntze, l. c.  
*C. Simsii* β. *normalis* Kuntze, l. c., in part.  
*C. Simsii* γ. *lobata* Kuntze, l. c.  
*C. Simsii* 1. *leiostylis* Kuntze, l. c.  
*C. Simsii* 2. *lasiostylis* Kuntze, l. c.  
*C. Pitcheri* var. *Sargentii* Davis ex Bailey, Cycl. Am. Hort. 1:333. 1900.  
*Viorna Simsii* Small, Fl. Southeast. U. S. 438, 1330. 1903.  
*V. Pitcheri* Britt. ex Britt. & Br. Ill. Fl. ed. 2, 2:123, fig. 1946. 1913; Rydb. Fl. Prair. & Plains, 336. 1932; Small, Man. Southeast. Fl. 527. 1933.  
*C. Simsii* var. *Sargentii* Rehder in Mitt. Deutsch. Dendr. Ges. 22:255. 1913.

A vine, simple or somewhat branched; stem 6-angled or ribbed, reddish-brown, nearly glabrous or sparsely pubescent, especially at the nodes; cauline leaves with 3-5 leaflets, rachis slender, usually slightly geniculate, terminating in a slender tendril-like filament; leaflets simple, slightly or deeply 2-5-lobed, or 3-foliolate, the ultimate leaflets varying greatly in size and shape from narrowly ovate or elliptical to broadly ovate-cordate, blunt to acute-tipped, mucronate, lowest leaflets 4-10 cm. long, blades chartaceous to coriaceous, nearly glabrous or quite pubescent below, obscurely to very strongly reticulate, but not so closely as in *C. reticulata*; peduncles axillary, 1-7-flowered, floral leaves usually smaller than, but sometimes exceeding, the cauline leaflets, simulating them in shape and other characters but with a short petiole; flowers nodding, ovoid to urceolate; sepals

slightly exceeding the stamens to twice their length, ribbed, short appressed-pubescent without, dull purple to brick-red without, deeply colored or greenish within, margins unexpanded, or moderately expanded above the middle, white-tomentose, spreading or recurved at the tip; achene-bodies orbicular, suborbicular or obscurely quadrangular, more or less inequilateral, 6-8 mm. broad, with a broad, thick rim, appressed-pubescent; achene-tails about 3 cm. long, but usually broken and hence much shorter, slender and tapering, sparsely appressed-pubescent or nearly glabrous to silky or villous, but not plumose.

DISTRIBUTION: from Indiana to eastern Nebraska and south to Texas.

INDIANA.—DAVIESS CO.: Glendale, 6 June 1889, *Evermann* (US). GIBSON CO.: 5 m. n.w. of Patoka, *Deam* 16919 (G, UM). KNOX CO.: 16 mi. w. of Decker, *Deam* 17044 (G, US). POSEY CO.: 5 mi. w. of Mt. Vernon, *Deam* 16801 (UM). VIGO CO.: Terre Haute, July 1884, *Mohr & Mohr* (US). WARREN CO.: 3 Aug. 1876, *Shipman* (G, PA).

KENTUCKY.—LYON CO.: Kuttawa, *Eggleston* 4551 (NY). MCCracken CO.: Paducah, *Palmer* 17886 (MBG, US). UNION CO.: Rockford Bridge, *Shacklette* 398 (G).

TENNESSEE.—DAVIDSON CO.: Edgefield Junction, 8 June 1883, *Gattinger* (NY); Nashville, 1887, *Gattinger* (NY, UP), and *Hubbard* 5 (NY).

ILLINOIS.—ADAMS CO.: Bluff Hall, *Evers* 188 (MBG). CARROLL CO.: Savannah, *Chase* 1874 (UM, US). CASS CO.: Beardstown, *Geyer* (MBG). CHAMPAIGN CO.: Stanton, 7 June 1919, *Pease* (G, UP); Urbana, 21 July 1884, *Waite* (US). FULTON CO.: Otter Creek, 6 June 1888, *Pepoon* (UM), and 1586 (G). GALLATIN CO.: Shawneetown, *Palmer* 15483 (MBG). HANCOCK CO.: Warsaw, 17 June 1847, *Mead* (G). HARDIN CO.: Rosiclair, *Palmer* 15454 (MBG). HENDERSON CO.: Oquawka, June and Aug. 1875, *Patterson* (MBG, NY). KANKAKEE CO.: Kankakee, *Crampton* 225 (US), and *Greenman* 3546 (G, MBG); 7 mi. n.w. of Kankakee, *Sberff* 1631 (MBG). LA SALLE CO.: Peru, Sept. 1840, *Engelmann* (MBG), and 5 Aug. 1850, *Holton* (NY). LOGAN CO.: Sugar Creek, collector unknown (NY). MACON CO.: Cowford Bridge, *Clokey* 2425 (G, MBG, NY, UM, US); Decatur, *Gleason* 194 (G), and 21 July 1940, *Mills* (NY). MARION CO.: Salem, June 1860, *Bebb* (G, PA). MENARD CO.: Athens, 1861, *Hall* (PA), and Aug. 1868 (MBG). MORGAN CO.: Jacksonville, May 1870, *Milligan* (US). PEORIA CO.: Peoria, June-July 1903, *McDonald* (NY), and July 1904 (G, UM); Peoria, *Stewart* (PA). PIATT CO.: Monticello, 30 July 1880, *Piatt* (DU). PIKE CO.: East Hannibal, *Davis* 906, 6400, 7330a (MBG), 7330 (TEX). ST. CLAIR CO.: Fish Lake, 19 June 1891, *Douglass*, and 4 mi. s. e. of East Carondelet, 4 Sept. 1891 (MBG); *Engelmann* 743 (MBG); East St. Louis, 9 July 1895, *Glatfelter* (UM, US); Belleville, 1879, *Herzog* (NY); East St. Louis, 6 Sept. 1897, *Norton* (MBG); Fish Lake, 9 June 1886, *Trelease* (MBG). STARK CO.: Spoon River, 20 June 1896, *Chase* (PA). TAZEWELL CO.: Minert, 22 July 1881, *Seymour* (DU). UNION CO.: Wolf Lake, *Gleason* 9016 (NY). WABASH CO.: Mt. Carmel, *Schneck* 1150 (G); Bon Pas bottoms, 28 June 1895, *Shearer* (UM). WHITESIDE CO.: Fulton, *Vasey* 130 (G, NY). WOODFORD CO.: Wyatt's Ford, Aug. 1886, *Robinson* (G). COUNTY NOT DETERMINED: *Hall* (US); 1875, *Hyatt* (NY).

IOWA.—APPANOOSE CO.: Sedan, *Palmer* 27893 (MBG). BLACK HAWK CO.: Snag Creek prairie, *Burk* 780 (MBG). DECATUR CO.: 29 June 1904, *Anderson* (MBG); 7 Apr. 1898, *Fitzpatrick & Fitzpatrick* (US). JOHNSON CO.: Iowa City, 3 Aug. 1929, *Barker* (TEX); 28 June 1894, *Fitzpatrick* (G). KEOKUK CO.: Butler's Landing, *Somes* 3485 (US). MUSCATINE CO.: Muscatine, *Pammel & Reppert* 1236 (MBG). POLK CO.: Iowaville, 25 June 1841, *Geyer* (MBG). POWESHIEK CO.: Grinnell, Aug. 1875, *Jones* (NY, US). STORY CO.: Ames, *Ball* 217 (FM, G, MBG, NY, US), and Oct. 1906, *Pammel* (G). TAMA CO.: Tama, *Wiegand et al.* 946 (FM). VAN BUREN CO.: Stockport, *Graves* 2016 (MBG). WAPELLO CO.: 2 mi. w. of Eldon, *Hayden* 9441 (MBG, NY, UM). COUNTY NOT DETERMINED: *Jones* 147 (MBG); *Perry* (MBG); Cedar River, June 1884, *Treat* (UP).

MISSOURI.—ADAIR CO.: Kirksville, 8 July 1887, *Sheldon* (NY). ANDREW CO.: Nodaway, *Steyermark* 15180 (MBG). ATCHISON CO.: Watson, *Bush* 11 (MBG). AUDRAIN CO.: 4 mi. n. e. of Molino, *Steyermark* 22441 (FM). BARRY CO.: Eagle Rock, *Bush* 30, and Shell Knob, 15564 (MBG). BATES CO.: 1.5 mi. n. w. of Papinsville, *Steyermark* 9912 (FM, MBG), and 1.3 mi. s. w. of Papinsville, 9973 (FM). BENTON CO.: 2 mi. n. w. of Wisdom, *Steyermark* 24424 (FM, MBG). BUTLER CO.: Poplar Bluff, 14 Aug. 1892, *Dewart* (MBG). CALDWELL CO.: 1.5 mi. s. of Kingston, *Steyermark* 6096 (FM, MBG). CARROLL CO.: 1889, *Bush* (US). CASS CO.: 14 June 1865, and Pleasant Hill, *Broadhead* (MBG). CEDAR CO.: 6 mi. s. w. of Bear Creek, *Steyermark* 27518 (FM). CHARITON CO.: 4 mi. n. e. of Keytesville, *Steyermark* 26443 (FM, MBG). CHRISTIAN CO.: 3.5 mi. s. e. of Chadwick, *Steyermark* 23036 (FM, MBG). CLARK CO.: 3 mi. n. of Gregory Landing, *Drouet* 1717 (G); Alexandria, July 1893, *Wislizenus* (MBG). CLAY CO.: Excelsior Springs, *Duncan & Moyer* 1586 (NY, UM). COLE CO.: 4 mi. n. of St. Thomas, *Steyermark* 24939 (FM, MBG). CRAWFORD CO.: Leasburg, *Steyermark* 1240 (MBG), and 3 mi. n. e. of Davisville, 21076 (MBG). DADE CO.: s. w. of Seybert, *Steyermark* 5660 (FM). DALLAS CO.: 2 mi. s. w. of Windyville, *Steyermark* 13749 (MBG); 5 mi. s. w. of Long Lane, *Steyermark* 24239 (FM, MBG). DOUGLAS CO.: Roosevelt, *Steyermark* 23316 (FM, MBG). FRANKLIN CO.: Gray Summit, 6 July 1940, *Anderson* (MBG); Washington, 25 June 1888, *Pammel* (MBG). GREENE CO.: Springfield, 26 May 1888, *Blankinsbip* (MBG); Ash Grove, *Standley* 9271 & 9316 (US). GRUNDY CO.: Trenton, *Palmer* 25487 (MBG). HENRY CO.: 3-4 mi. n. of Brownington, *Steyermark* 7442 (FM). HICKORY CO.: 3 mi. n. e. of Elkton, *Steyermark* 24490 (FM, MBG). HOWELL CO.: 2 mi. s. w. of Moody, *Steyermark* 5241 (FM). JACKSON CO.: Independence, 31 July 1882, *Bush* (MBG); Sheffield, *Bush* 10 (G, MBG, ND, NY), & 729 (MBG), and Grain Valley, 134 (MBG); Buckner, *Bush* 6766, 12536 (MBG); w. of Levassey, 5 July 1897, *Mackenzie* (NY, UM), and Westport, 181 (MBG). JASPER CO.: Webb City, *Bush* 6066 (MBG), and *Palmer* 477 (MBG); Carterville, *Palmer* 697, Joplin, 698, 4 mi. e. of Carthage, 1101, Forest Mill, 2326, Carthage, 23406 (MBG). JEFFERSON CO.: Pacific, 24 May 1882, *Eggert* (FM, MBG), and Victoria, 24 Aug. 1892 (MBG); May-June 1887, *Hasse* (FM, MBG, NY, UM); Victoria, 8 Aug. 1890, *Hitchcock* (MBG); Dittmer, *Kellogg* 1744 (MBG); 6 mi. s. of Eureka, *Steyermark* 1239 (MBG). JOHNSON CO.: Columbus, *Palmer* 36694 (MBG). LACLEDE CO.: Bridge no. 5, 4 July 1937, *Moore* (FM); 5 mi. s. w. of Eldridge, *Steyermark* 27197 (FM). LAFAYETTE CO.: Emma, 14 Aug. 1896, *Demetrio* (US). LINCOLN CO.: Winfield, *Davis* 1413 (MBG). LINN CO.: Laclede, 11 July 1886, *Wislizenus* (MBG). MARION CO.: Mark Station, 10 July 1917, *Davis* (TEX), and 3748, 4171 (MBG). MONITEAU CO.: 3.5 mi. s. of Jamestown, *Steyermark* 24833 (FM, MBG). NEWTON CO.: 15 July 1893, *Bush* (FM, MBG); Redings Mill, *Palmer* 14369 (MBG). OSAGE CO.: 4 mi. e. of Freeburg, *Steyermark* 5804 (FM, MBG). PHELPS CO.: Jerome, 25 June 1912, *Kellogg* (MBG, US), 273 (MBG), and Arlington, *Kellogg* 1743 (MBG). POLK CO.: 2.5 mi. e. of Eudora, *Steyermark* 24053 (MBG), and 1-2 mi. s. e. of Sentinel, 27245 (FM). PULASKI CO.: Dixon, 1928, *Child* (MBG); highway 28 at Gasconade River, *Drouet* 3 (MBG). REYNOLDS CO.: w. of Gads Hill, *Steyermark* 14205 (MBG). ST. CLAIR CO.: 3 mi. n. of Taberville, *Steyermark* 7595 (FM, MBG). ST. FRANCOIS CO.: 1 mi. n. of Koester, *Erickson* 508 (MBG). ST. LOUIS CO.: Allenton, 14 June 1887, *Eggert* (MBG, US), and 24 June 1887 (G, MBG, NY, UM, US); Valley Park, 21 June 1891, *Eggert* (MBG); Meramec Bend, 9 June 1892, *Glatfelter* (MBG, US); Glencoe, *Greenman* 3850 (MBG); St. Albans, 1 June 1918, *Hoffman* (MBG); Allenton, 6 Aug. 1880, *Kellogg* (MBG); Allenton, June 1882, *Letterman* (US), 20 June 1887 (MBG, NY, PA, TEX, US), May 1889 (MBG), 1893 (MBG, TEX, UM, US), and 15 July 1898 (NY, PA, TEX, US); Meramec Highlands, 13 June 1909, *Ohlweiler* (MBG). ST. LOUIS CITY: 9 June 1901, *Kellogg* (MBG, PA, UM, US), June 1875, *Letterman* (MBG). SCHUYLER CO.: 2 mi. e. of Livonia, *Palmer & Steyermark* 41068 (MBG). SHANNON CO.: 22 July 1891, *Bush* (MBG, NY, PA); Alley Spring State Park, *Steyermark* 2098 (FM, MBG). STONE CO.: Galena, *Palmer* 5794 (MBG, US); 2 mi. s. e. of Dorcas, *Steyermark* 22679 (FM, MBG). SULLIVAN CO.: Paw Paw Junction, *Bush* 52 (MBG); TANAY CO.: Swan, *Bush* 163 (G, MBG, ND). TEXAS CO.: Plato, *Steyermark* 25028 (FM, MBG). VERNON CO.: Deerfield, *Palmer & Steyermark* 42144

(FM, MBG, PA). WASHINGTON CO.: Potosi, 3 June 1892, *Dewart* (MBG). WEBSTER CO.: 3 mi. w. of Forkner's Hill, *Steyermark* 23934 (FM, MBG). WRIGHT CO.: 2 mi. s. e. of Cedar Gap, *Steyermark* 23694 (FM). COUNTY NOT DETERMINED: *Bush* 137 (US); Meramec River, 28 July 1891, *Douglass* (MBG); 25 June 1873, *Eggert* (US); Grand River, Aug. 1871, *Meehan* (PA).

ARKANSAS.—HEMPSTEAD CO.: Columbus, *Palmer* 10508 (MBG, US). PULASKI CO.: Pinnacle, *Wheeler* 56 (FM). VAN BUREN CO.: Shirley, *Palmer* 25181 (MBG). COUNTY NOT DETERMINED: Red River, *Pitcher* (NY TYPE, PA).

NEBRASKA.—RICHARDSON CO.: s. e. of Rulo, *Reynolds* 2877 (NEB); e. of Du Bois, *Reynolds* 2940 (NEB).

KANSAS.—COWLEY CO.: 8-10 mi. n. e. of Arkansas City, *Rydberg & Imler* 529 (NY); June 1898, *White* (MBG). FRANKLIN CO.: Pomona, *Palmer* 43969 (MBG). GEARY CO.: Whiskey Lake, *Gates* 18683 (MBG). JEFFERSON CO.: 5 mi. n. w. of Lawrence, *Erickson* 509 (MBG); Aug. 1870, *Hall* (FM). MIAMI CO.: Paola, June 1884, *Oyster* (NY). RILEY CO.: Manhattan, 12 Aug. 1892, *Hitchcock* (US), and 5 July 1886, *Kellerman* (MBG, UM, US); Manhattan, Aug. 1892, *Norton* (ND), and 1, 1a (MBG, NY, US); 21 Aug. 1894, *Payne & Morse* (ND); Manhattan, 30 June 1892, *Reed* (MBG). SHAWNEE CO.: Topeka, *Smyth* 12 (NY). SUMNER CO.: Geuda, 4 July 1887, *Bassler* (US). WILSON CO.: Neodesha, *Palmer* 21384 (US).

OKLAHOMA.—BRYAN CO.: *Blain* 263 (US). CADDO CO.: between Fort Cobb & Fort Arbuckle, 1868, *Palmer* 2 (NY, US). CLEVELAND CO.: 3 mi. s. of Norman, *Berkley* 1466 (MBG, UM). COMANCHE CO.: Fort Sill, *Clemens* 11585, 11585a (MBG); Camp Boulder, *Shirley* 1429 (MBG); Cache, *Stevens* E.M.-7 (G, MBG, UM, US). GARVIN CO.: Turner Falls State Park, *Palmer* 42057 (MBG, NY, US). IOWA CO.: Mountain Park, *Stevens* 1220 (G, UM). LINCOLN CO.: 4 July 1895, *Blankinship* (US), and Fallis, 20 Aug. 1895 (G). MURRAY CO.: Davis, *Demaree* 12900 (UM); Platt National Park, *Merrill* 584 (MBG), 696 (NY), *Merrill & Hagan* 403 (FM), and 508 (US); Davis, *Palmer* 44017 (MBG). OSAGE CO.: Copan, *Stevens* 2160 (G, UM). OTTAWA CO.: Miami, *Stevens* 2327 (G, NY, UM). PAYNE CO.: 8.5 mi. e. of Stillwater, *Fox* 80 (PA); 0.5 mi. s. of Stillwater Creek Bridge, *Gruver* 64 (TEX); Stillwater, 23 Sept. 1899, *Miller* (UM), 20 June 1896, *Morris* (UM, US), 17 July 1897, *Myers* (US); *Olive* 1 (NY); w. of Mehan, *Stratton* 185, and 4.3 mi. s. e. of Stillwater, 265 (MBG). WASHINGTON CO.: Copan, *Stevens* 2093 (G, UM). COUNTY NOT DETERMINED: Arkansas River, *Bush* 1 (MBG); Osage Nation, 30 Aug. 1895, *Kimmons* (G, US), and Creek Nation, 22 Aug. 1895 (G); *Waugb* 159 (US).

TEXAS.—ARMSTRONG CO.: Gamble's Ranch, *Palmer* 13951 (MBG, US). AUSTIN CO.: Industry, 1844, *Lindheimer* (MBG); e. of Wallis, *Pennell* 10261 (NY, PA). BELL CO.: 1927, *Normand* (TEX); 6 mi. n. of Belton, *Wolff* 855 (US), and s. of Little River, 2261 (ND, TAM). BEKAR CO.: San Antonio, *Clemens & Clemens* 784, 785 (FM, MBG); San Antonio, *Jermy* 242 (G), and May 1923, *Richter* (TEX); Indianola, Sept. 1850, *Thurber* (G); San Antonio, 1853, *Thurber* (NY), 1900, *Wilkinson* (MBG), and 90 (MBG). BOWIE CO.: Texarkana, *Bush* 2494 (AA, MBG). BRAZORIA CO.: Columbia, *Bush* 876, 1484 (MBG). BROWN CO.: Brownwood, *Palmer* 29569 (MBG). BURNET CO.: Marble Falls, *Biltmore Herb.* 8129e (UM, US), *Bray* 108 (NY), and 29 May 1922, *Tharp* (TEX). COMAL CO.: New Braunfels, May 1848, *Lindheimer* (MBG), 384 (G, MBG, PA), 627 (G), 654 (FM, G, MBG, NY, US), 655 (FM, G, MBG, NY, PA, TEX, US), 657 (TEX). CONCHO CO.: Concho, July 1881, *Havard* (US). DALLAS CO.: Dallas, *Biltmore Herb.* 8129a, 8129b (US); West Dallas, 23 June 1899, *Eggert* (MBG); Dallas, 16 June 1898, *Glatfelter* (MBG), 3 July 1872, *Hall* (FM), 1 June 1925, *Hynes* (TEX), and *Letterman* 76 (MBG); 25 June 1874, *Reverchor* (MBG); Dallas, June-July 1877 (NY), June-July 1879 and June 1881 (US), 2961 (MBG), and *Stephenson* 148a (US). DENTON CO.: spring 1926, *Harris* (TEX); *Ruth* 1488 (US). DUVAL CO.: 16 Oct. 1935, *Tharp* (TEX). EDWARDS CO.: *Parks & Cory* 7425 (TAM). GALVESTON CO.: Arcadia, *Degener* 4968 (NY). GILLESPIE CO.: Enchanted Rock, *Jermy* 231 (MBG). GONZALES CO.: Ottine Swamp, *Parks & Cory* 5682 (TAM). GUADALUPE CO.: Seguin, *Groth* 191 (FM, G, NY, US); Cibolo, 3 May 1881, *Havard* (US). HARDIN CO.: 7.5 mi. w. of Silsbee, *Parks & Cory* 11218 (TAM). HARRIS CO.: Houston, *Dixon* 615

(FM), and *Fisher* 5086 (US); Harrisburg, *Lindheimer* 5 (G, MBG, PA); 1927, *Shurrow* (TEX). HAYS CO.: San Marcos, 11 June 1897, *Trelease* (MBG); San Marcos, 17 May 1921 and 7 Oct. 1928, *Whitehouse*, and 7 Oct. 1938 (TEX). HOOD CO.: Granbury, 6 May 1900, *Eggert* (MBG), and *Palmer* 6509 (MBG, US). IRION CO.: Mertzon, 9 May 1924, *Cory* (TAM). KERR CO.: Kerrville, *Bray* 279 (TEX, US), *Clark* 558 (MBG), *Heller* 1607 (FM, G, NY, PA, UM, US), 1608 (MBG, UM), July 1889, *Munson & Hopkins* (US), and *Palmer* 9938 (MBG, US); 7 June 1929, *Whitehouse* (TEX). KLEBERG CO.: summer 1940, *Sinclair* (TEX). LA SALLE CO.: Cotulla, *Palmer* 11315 (MBG). LLANO CO.: Enchanted Rock, *Jermy* 231 (MBG, US); Bauman's, *Parks & Cory* 6220 (TAM). MCCULLOCH CO.: Brady, *Studhalter* 1098 (US). MCLENNAN CO.: Waco, 1893, *Pace* (MBG). MATAGORDA CO.: Palacios, *Tharp* 2383 (TEX, US). MONTGOMERY CO.: *Parks* 14508 (TAM); Abilene, *Blackwell*, *Palmer* 34584 (NY), and *Studhalter* 1197 (US). NUECES CO.: Nueces, Aug. 1881, *Buckley* (NY). RANDALL CO.: 14 June, *Neeley* (TEX). REAL CO.: 16 mi. n. of Leakey, *Cory* 12612 (G); Thousand Springs, *Parks & Cory* 8526, 12610, 12611 (TAM). REFUGIO CO.: Tivoli, 17 Apr. 1933, *Whitehouse* (TEX). RUNNELS CO.: Ballinger, *Nealley* 378 (NY). SAN SABA CO.: San Saba, *Harris* 523 (US). SOMERVELL CO.: 1 mi. above Glen Rose, 10 Oct. 1891, *Ward* (US). SUTTON CO.: Sonora Station, 26 June 1925, *Cory* (TAM). TARRANT CO.: Fort Worth, *Ruth* 288 (G, MBG, NY, UP, US), 384 (FM, MBG, NY, UM); Trinity River, *Ruth* 767 (PA, US). TAYLOR CO.: Buffalo Gap Hills, *Cory* 8688 (G); Sayles, *Parks & Cory* 8687 (TAM); Abilene, *Tracy* 8064 (FM, G, MBG, ND, NY, TEX, UM, US). TOM GREEN CO.: San Angelo, *Palmer* 11152 (MBG); San Angelo, May 1888, *Smith* (FM); 1879, *Tweedy* (NY), and Knickerbocker Ranch, 165 (US). TRAVIS CO.: Austin, *Biltmore Herb.* 8129b, c, d, g & h (US), and *Painter* 107 (TEX); n.w. of Austin, 23 Aug. 1921, *Tharp*, and Austin, 3 May 1930 (TEX); Barton Creek, spring 1911, *Young* (TEX). UVALDE CO.: Concan, *Palmer* 10201 (MBG, US). VALVERDE CO.: Devil's River, *Orcutt* 6003 (MBG); n. of Del Rio, 25 Apr. 1903, *Pilsbry* (PA). VICTORIA CO.: Victoria, *Howell* 349 (US). WEBB CO.: Laredo, Aug. 1880, *Palmer* 7 (G, US). WILLIAMSON CO.: Round Rock, *Bodin* 111 (US). ZAVALA CO.: Crystal City, *Hanson* 688 (MBG, NY, US). COUNTY NOT DETERMINED: *Drummond* (G); Santiago, 1889, *Nealley* (FM); on the Llano, Oct. 1847, *Lindheimer* (MBG); New Gulf, 15 July 1933, *Whitehouse* (TEX); *Wilkinson* (MBG); 1845, *Wright* (G); Guadalupe, May, *Wright* (US).

The diversity of the plants included here under *C. Pitcheri* is not paralleled by any other species of the section. Certain geographical trends in the variation can be pointed out, but it has not been possible to find any consistent basis for the setting off of varieties, except the one described below. In the northern part of the range of *C. Pitcheri*, the leaves are not as much divided, and the leaflets are larger than in the Texas specimens. The expanded margin of the sepals is poorly developed in the northern part of the range, the flowers simulating those of *C. Viorna*, while farther south the margin is rather wide, so much so, in fact, that this species has been confused in the literature with *C. crispata*. Pubescence of the lower leaf surfaces is more pronounced in many of the Texan plants than in those of the more northern states. A variety *lasiostylis* was proposed by Gray to accommodate those plants, mainly from the Edwards Plateau region, which have villous achene-tails. This character, however, does not appear to correlate with other characters, and furthermore intergrades with less pubescent and glabrous achene-tails. Segregates which might be based on other characters seem to be just as untenable.

The confusion of *C. Pitcheri* with *C. reticulata*, which has so often occurred,

does not seem justifiable. The two species are well separated on the basis of leaflet shape, degree of reticulation, and nature of the achene-tails, which are plumose in *C. reticulata* but not in *C. Pitcheri*.

9a. *Clematis Pitcheri* var. *filifera* (Benth.) Robins. ex Gray, Syn. Fl. N. Am. 1:6. 1895.

*C. filifera* Benth. Pl. Hartw. 285. 1839; Tidestr. Fl. Ariz. & N. Mex. 34. 1941.

*C. Simsii* & *filifera* Kuntze in Verh. Bot. Ver. Brandenb. 26:135. 1885.

*C. filifera* var. *incisa* Hemsl. Biol. Centr.-Am. Bot. 1:2. 1888.

*C. dictyota* Greene in Pittonia 5:133. 1903.

*Viorna dictyota* Heller in Muhlenbergia 6:96. 1910.

*V. filifera* Woot. & Standl. Contr. U. S. Nat. Herb. 16:123 1913; Woot. & Standl. Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915.

Leaves considerably divided; leaflets comparatively small, acute or acuminate, coriaceous, strongly reticulated, pubescent below; sepals always with expanded margins above the middle; otherwise as in the species.

DISTRIBUTION: along banks of streams and in canyons, western Texas, New Mexico, and Mexico.

TEXAS.—BREWSTER CO.: Chisos Mtns., Bailey 374 (US); Marathon, Berkman 3424 (TEX); Chisos Mtns., Cory 6992 (G), Hinckley 840 (FM, G), and Marsh 193 (FM); Oak Canyon, Moore & Steyermark 3382 (G, MBG, NY, PA, UM, US); Chisos Mtns., Muebler 8001 (FM, MBG, NY, TEX, US); Alpine, Palmer 30510 (G), and Chisos Mtns., 34160 (MBG, NY, PA); Oak Canyon, Parks & Cory 6991 (TAM); between Alpine and Fort Davis, Small & Wherry 12046 (NY); Buena Vista, Sperry T153 (US); Chisos Mtns., Sperry 203 (US), 1571 (G); n. of Alpine, Steiger 264, 1262, Chisos Mtns., 1144, and w. of Alpine, 1405 (NY); Alpine, Studhalter 1030, 1070 (US), and April 1925, Wherry (UP); Chisos Mtns., 7 & 14 Aug. 1915, & 15 Aug. 1920, Young (TEX). CULBERSON CO.: McKittrick Canyon, Moore & Steyermark 3590 (G, MBG, NY, PA, UM); Guadalupe Mtns., 5 July 1931, Whitehouse (TEX), 28 Aug. 1916, Young (MBG, TEX), and 2 Sept. 1916 (TEX). JEFF DAVIS CO.: Limpia Canyon, Earle & Tracy 256 (NY); Little Aguja Canyon, Moore & Steyermark 3096 (G, MBG, NY, PA, UM); Davis Mtns., Palmer 30679 (G, TEX), Fort Davis, 32165 (G, TEX), and Little Aguja Canyon, 34553 (NY); Limpia Canyon, Tracy & Earle 256 (ND, TAM, TEX), Wright 454 (G); Star Mtn., 12 May 1914, Young (MBG); Davis Mtns., 12 May 1914, 12 Aug. 1914, 12 May 1917, and 18 Sept. 1918, Young (TEX). PRESIDIO CO.: Chinati Mtns., Harvard 2 (G), and Aug. 1936, Hinckley (TEX). COUNTY NOT DETERMINED: Limpia River, Bigelow (NY); Colorado River, May 1861, Buckley (NY); 1887, Nealley (US).

NEW MEXICO.—CHAVES CO.: Roswell, Earle & Earle 243 (MBG, NY, PC, UM, US); 9 mi. above Roswell, Peacock 12 (US). DONA ANA CO.: below Dona Ana, Emory (NY). EDDY CO.: 45 mi. s. w. of Carlsbad, Grassi 3 (FM, NY); Carlsbad Cavern, Lee 107 (US); Black River, Standley 40450 (US); Guadalupe Mtns., Wilkens 1724, 2240 (PA). GRANT CO.: Santa Rita del Cobra, Bigelow (NY). LINCOLN CO.: El Capitan Mtns., 31 Aug. 1900, Earle & Earle (NY); White Mtns., 5 Aug. 1901, Wootton (MBG, NY, PC, US). OTERO CO.: Guadalupe Mtns., 3 Aug. 1909, Beede, Chapline 683, 733, and Standley 40651, 40762 (US). TORRANCE CO.: Cibola Valley, 6 July 1852, Parry (NY). COUNTY NOT DETERMINED: Fendler 2 (MBG); Upper Canadian River, Apr. 1848, Gordon (MBG); Limpia River, Wright 830 (PA, US); Wright 831 (US).

MEXICO.—COAHUILA: Sabinas, Nelson 6168 (US); Mt. Caracol, 1880, Palmer 4 (G, PA), Saltillo, 1880, 5 (G, PA, US), 40 mi. s. of Saltillo, 1880, 6 (G), 6 mi. e. of Saltillo, 1880, 8 (G, PA, US), Saltillo, 1898, 123 (G, MBG, NY, US); Cañon del Indio Felipe, Stewart 136 (G); Sierra del Carmen, Wynd & Mueller 522 (G, MBG, NY, US).

GUANAJUATO: Guanajuato, *Dugès* 342 (G). HIDALGO: Jacala, *Chase* 7193 (G); Zimapan, *Coulter* 642 (G, NY, PA); Tula, *Pringle* 11911 (G, US); Ixmiquilpan, *Purpus* 472 (MBG, US); Huejutla, *Seler* 648 (G). NUEVO LEÓN: Monterrey, *Arsène* 6193 (US), *Mueller & Mueller* 36 (TEX); 15 mi. s. w. of Galeana, *Mueller & Mueller* 473, 474 (NY, TEX); Galeana, *Taylor* 100 (MBG, TEX). QUERÉTARO: *Arsène* 10298 (G, MBG, US), and 10456, 10484, 10487 (US); Tequisquiapan, *Nelson* 3876 (G, US). SAN LUIS POTOSÍ: Alvarez, 1904, *Palmer* 194 (G, MBG, NY, US); 1878, *Perry & Palmer* 1 (G, MBG, NY, PA); Las Canoas, *Pringle* 3648 (G); Bagre, *Purpus* 5233 (G, MBG, NY, US); *Schaffner* 29 (G), 518 (NY, US). STATE NOT DETERMINED: Guanchucho, 1880, *Dugès* (G); *Ehrenberg* (US); Faral, *Schumann* 254 (G, US).

This variety is fairly well set off from *C. Pitcheri* by the greater compounding of its leaves, but it shows the same variation in pubescence of the achene-tails, and some other characters as the species.

#### Subsection 2. VITICELLAE

Characters of the species. Sp. 10.

10. *Clematis crispa* L. Sp. Pl. 543. 1753; Gray in Bot. Mag. pl. 6594. 1881; James in Jour. Cincin. Soc. Nat. Hist. 6:123. 1883; Gray, Syn. Fl. N. Am. 1:7. 1895; Britt. & Br. Ill. Fl. 2:68. 1897; Britt. Man. 421. 1901; Gray, Man. ed. 7, 403. 1908; not Thunb. Fl. Jap. 239. 1784.

*Clematis crispa* Moench, Meth. 296. 1794.

*Clematis cylindrica* Sims in Bot. Mag. pl. 1160. 1809.

*C. divaricata* Jacq. Eclog. Pl. 1:51, pl. 33. 1811.

*C. Walteri* Pursh, Fl. Am. Sept. 2:384. 1814.

*C. cordata* Sims in Bot. Mag. pl. 1816. 1816.

*C. lineariloba* DC. Syst. 1:155. 1818.

*Viticella crispa* Bercht. & Presl, Rostl. 1:11. 1823.

*C. Simsii* Sweet, Hort. Brit. ed. 1, 1. 1826; not Kuntze in Verh. Bot. Ver. Brandenb. 26:134. 1885; nor Britt. in Mem. Torr. Bot. Club 5:158. 1894; nor authors.

*C. Pitcheri* Carr. in Rev. Hort. 1878:10. 1878; not T. & G. Fl. N. Am. 1:10. 1838.

*C. crispa* var. *Walteri* Gray in Bot. Mag. pl. 6594. 1881; James in Jour. Cincin. Soc. Nat. Hist. 6:123. 1883; Gray, Syn. Fl. N. Am. 1:7. 1895.

*C. Viticella a. crispa* Kuntze in Verh. Bot. Ver. Brandenb. 26:136. 1885.

*C. Viticella a. crispa* 1. *pilostylis* Kuntze, l. c.

*C. Viticella a. crispa* 2. *leiostylis* Kuntze, l. c.

*C. Viticella γ. Walteri* Kuntze, l. c. 137.

*C. Viticella γ. Walteri* 2. *lineariloba* Kuntze, l. c.

*Viorna cylindrica* Spach, Hist. Nat. Vég. Phan. 7:269. 1839.

*V. crispa* Small, Fl. Southeast. U. S. 437, 1330. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:123. 1913; Small, Man. Southeast. Fl. 527. 1933.

*V. crispa* var. *Walteri* Small, Fl. Southeast. U. S. 438, 1330. 1903.

*V. obliqua* Small, l. c. 438. 1331; Small, Man. Southeast. Fl. 527. 1933.

*C. obliqua* Schneider, Handb. Laubholz. 1:277. 1904.

A vine; stem slender, 6–12-angled or -ribbed, slightly pubescent at the nodes;

leaves pinnate with 2-5 pairs of leaflets, terminating in a small leaflet or in a tendril-like filament, rarely simple or 3-foliolate; leaflets usually simple and entire, but also 2-3-lobed or 3-foliolate; leaflets usually lanceolate, but varying from narrowly linear to ovate-cordate, usually acuminate, thin, glabrous, with three apparent veins from the base, but not reticulate; pedicels solitary, terminal at the ends of stems or axillary branches, without simple floral leaves; flowers 2-4 cm. long, cylindric-campanulate or urceolate-campanulate; sepals lanceolate, thin, 2-3 times as long as the stamens, with a widely expanded, crisped or undulate margin above the middle, blue or blue-purple within and without, glabrous except the margin which is white-tomentose; achene-bodies suborbicular to quadrangular, usually somewhat inequilateral, 6-9 mm. broad, moderately rimmed, finely appressed-pubescent; achene-tails stout below, tapering and slender above, 2-3 cm. long; finely appressed-pubescent, divergent, sometimes coiled toward the tips.

DISTRIBUTION: in swamps and similar habitats; Atlantic and Gulf Coastal Plain, and the Mississippi River Embayment.

VIRGINIA.—HENRICO CO.: Richmond, 1874, *Atwater* (US). NANSEMOND CO.: n. of Whitmarsh School, *Fernald & Long*, 10646, 10647, 10648 (G). NORFOLK CO.: between Northwest & Maycock, 25 May 1893, *Britton & Small* (FM, MBG, NY, PA, UP, US); North Landing, *Fernald & Griscom* 2821 (G); Great Bridge, *Fernald & Long* 3932 (G, UP), 3933 (G); Northwest, *Heller* 847 (MBG, PA, UM, UP); Dismal Swamp, *Kearney* 1503 (US), 4 June 1899, *Palmer & Bartsch* (G, MBG, US), and *Pollard* 836 (FM, NY, US). PRINCESS ANNE CO.: Edgerriver Marshes, *Kearney* 1348 (US). SOUTHAMPTON CO.: Cypress Bridge, *Fernald & Long* 6209 (G, UP), 8269 (G), and Knight Seine Beach, 10267 (G); Franklin, *Heller* 847 (FM, G). SUSSEX CO.: s. e. of Burt, *Fernald & Long* 6597 (G, NY).

NORTH CAROLINA.—BEAUFORT CO.: Washington, 10 July 1934, *Blomquist* (PA), 3635, 5583 (DU), *Godfrey* 3746 (G). BLADEN CO.: Clarkton, *Biltmore Herb.* 1990b (G, NY, US); Elizabethtown, *Heller* 14082 (FM, MBG). BRUNSWICK CO.: Cape Fear River, June 1897, *Ashe* (MBG); Wilmington, 23 April 1923, *Churchill* (G, UM); Lake Waccama, 10 Apr. 1935, *Matthews* (DU). CAMDEN CO.: Elizabeth City, *Correll* 2081 (DU). CARTERET CO.: Newport, *Godfrey* 4448 (G); New Bern, *Hill* 122 (DU). CHOWAN CO.: Edenton, *Correll* 2042 (DU); Edenton, *Godfrey* 5342 (G). COLUMBUS CO.: Reaves Ferry, 25 June 1934, *Schallert* (ND), and Bughill, 9413 (DU); 3 mi. e. of Hallsboro, *Wiegand & Manning* 1200 (G). CRAVEN CO.: 2 mi. n. e. of Havelock, *Fogg* 5514 (UP). CURRITUCK CO.: Sligo, *Godfrey* 5291 (G). DUPLIN CO.: Rock Fish Creek, *Correll* 1309 (DU); e. of Chinquapin, *Leeds* 2888 (PA). HERTFORD CO.: Winton, *Godfrey* 5235 (DU, G). HYDE CO.: 5 mi. w. of Fairfield, *Godfrey & Kerr* 3853 (DU). IREDELL CO.: Statesville, *Hyams* (MBG, UM). JOHNSTON CO.: Princeton, 30 Apr. 1936, *Mitchell* (DU). MARTIN CO.: Jamesville, *Correll* 1879 (DU). NEW HANOVER CO.: Wilmington, 3 Oct. 1908, *Bartram* (PA), *Blomquist* 3637 (DU), 26 Apr. 1923, *Churchill* (G, MBG), and May 1881, *Hyams* (UM); Angola Bay, *Moldenke* 10430 (NY); n. of Wilmington, 12 May 1934, *Smith* (DU); Wilmington, July 1895, *Williamson* (PA). ONSLOW CO.: Lake Catherine, *House* 4529 (US); Camp Perry, *House* 5100 (NY). PASQUOTANK CO.: Elizabeth City, *Kearney* 2005 (US). PENDER CO.: Burgaw, May 1879, *Hyams* (MBG), and May 1880 (US). PERQUIMANS CO.: May 1932, *Glasson* (DU, UP); Parkville, *Randolph & Randolph* 671 (G). PITT CO.: 2 mi. w. of Grimesland, *Wiegand & Manning* 1199 (G). STANLEY CO.: falls of the Yadkin River, 23 Aug. 1894, *Small* (PA). TYRRELL CO.: Columbia, *Correll* 1887 (DU); 3 mi. w. of Columbia, *Godfrey & Kerr* 3931 (G). COUNTY NOT DETERMINED: Cape Fear River, June 1897, *Ashe* (MBG); Rose Bay, 10 June-6 July 1898, *Ashe* (NY); *Curtis* (MBG, NY, PA); *LeConte* (NY); 1885, *McCarthy* 1 (FM, US), 7, 18 (FM).

SOUTH CAROLINA.—BEAUFORT CO.: Hardeeville, April 1894, *Williamson* (PA), Mar.

(NY), and Lake Brantley, Aug. (NY). BERKELY CO.: 3 mi. n. e. of Pineville, *Godfrey & Tryon* 663 (G, NY). CHARLESTON CO.: Charleston, *Backman* (PA), and *Benke* 3790 (FM); St. Andrews, 18 May 1855, *Hexamer & Maier* (G); 14 mi. s. of Charleston, *Moldenke* 1219 (DU, MBG, NY, UP, US); St. Johns, collector unknown (NY). CLARENCE CO.: 10 mi. e. of Manning, *Stone* 575, 576 (PA). DORCHESTER CO.: Summerville, 13 Oct. 1835, *Gibbes* (NY), 16 Apr. 1888, *Hall* (FM), 7 Apr. 1903, *Macfarlane* (UP), *Robinson* 112 (G), and 17 May 1909, *Rusby* (NY); Summerville, April 1890, *Taylor* (FM, G); Summerville, June 1891, *Taylor* (UM, US). FAIRFIELD CO.: Rich Tex, 8 May 1928, *Anderson* (MBG). GEORGETOWN CO.: Georgetown, April 1857, *Gibbes* (NY); 4 mi. w. of Georgetown, *Godfrey & Tryon* 120 (G); 2 mi. n. e. of Andrews, *Godfrey & Tryon* 952, 975 (G). HORRY CO.: 4 mi. s. of Myrtle Beach, *Weatherby & Griscom* 16530 (DU, G, NY, UP, US). LEXINGTON CO.: Batesburg, *McGregor* 6 (US). ORANGEBURG CO.: 6 mi. s. e. of Bowman, *Hubricht* B1994 (MBG). WILLIAMSBURG CO.: Kingstree, *Palmer* 39842 (MBG, NY, UM, US). COUNTY NOT DETERMINED: *Ravenel* (G).

GEORGIA.—BLECKLEY CO.: Cary, 23 Apr. 1933, *West* (FLA). BURKE CO.: Ogeechee River Swamp, *Harper* 795 (G, MBG, NY, US). CHARLTON CO.: 6 mi. e. of Folkston, *Leeds* 2566 (PA). CHATHAM CO.: Savannah, 13 April 1897, *Gibbens* (PA, UP). DEKALB CO.: Stone Mtn., 1 June 1899, *Curtiss* (G). EARLY CO.: Blakely, 1882, *Wade* (US). FULTON CO.: South River, *Eyles* 1635 (DU). RICHMOND CO.: Augusta, 2 Apr. 1904, *Cuthbert* (FLA), and *Olney & Metcalf* 1 (G). TAYLOR CO.: Patsatiga Swamp, Aug. 1872, *Weisler* (G). COUNTY NOT DETERMINED: *Baldwin* (PA); *Read* (PA).

FLORIDA.—ALACHUA CO.: 5 mi. w. s. w. of Orange Heights, *Hubricht* B1992 (MBG); Gainesville, July 1934, *Weber & West* (FLA). BRADFORD CO.: between Graham and Brooker, 15 May 1940, *West & Arnold* (FLA). COLUMBIA CO.: June-July 1898, *Hitchcock* (MBG). DE SOTO CO.: from Zolfo Springs to Wauchula, *Small & DeWinkler* 9029 (NY), and Fort Ogden, 9 Dec. 1923 (FLA). DUVAL CO.: St. Nicholas, 20 Apr. 1897, *Churchill* (G, MBG); *Curtiss* (PA); St. John's River, *Curtiss* 8 (FM, G, MBG, NY, US), 383 (MBG); Jacksonville, 14 Apr. 1937, *Knight* (FLA); Arlington Creek, *Lightbipe* 582 (NY), and St. Nicholas, 583 (NY, UM, US). FRANKLIN CO.: Apalachicola, *Biltmore Herb.* 1990a (G, MBG, NY, US), and *Chapman Herb.* (MBG, NY). GADSDEN CO.: River Junction, *O'Neill* 547 (MBG, US). GILCHRIST CO.: Hart Springs, 21 June 1939, *West & Arnold* (FLA). JACKSON CO.: Chipola River, *Chapman* (NY); e. of Marianna, 15 Mar 1937, *Expl. Party* (FLA); 3.6 mi. s. s. e. of Campbellton, *Hubricht* B1991 (MBG); Marianna, 10 Sept. 1931, *West* (FLA). LA FAYETTE CO.: 9 mi. w. of Cross City, *Hume & West* (FLA). LEVY CO.: Gulf Hammock, 7 Apr. 1940, *Murrill* (MBG); Otter Creek, 11 Apr. 1934, and Gulf Hammock, 6 Apr. 1935, *West* (FLA, MBG); Fannin Springs, 2 May 1937, *West & Arnold* (FLA); Ellzey, 26 Mar. 1936, *West & Evers* (FLA, MBG); Wekiva River, 15 Apr. 1942, *West & Tissot* 77 (FLA). LIBERTY CO.: Aspalaga, May 1898, *Chapman* (MBG); Hosford, *Palmer* 38527 (MBG). MANATEE CO.: Myakka River, *Blodgett* (NY). ORANGE CO.: Wekiwa Springs, 9 July 1929, *Williams & West* (FLA). OSCEOLA CO.: Kissimmee, *Singletary* 164 (DU). PUTNAM CO.: Palatka, 1886, *Leeds* (FM). ST. JOHNS CO.: St. Augustine, 1872, *Reynolds* (NY); Pellicers Creek, 7 Sept. 1922, *Small, Small & DeWinkler* (G); St. Augustine, 18 Mar. 1876, *Smith* (US); Bakerville, 29 Aug. 1929, *West* (FLA). TAYLOR CO.: Hampton Springs, *Correll* 5724 (DU); Perry, 10 May 1926, *Small, Mosier & Matthaus* (NY); 3 mi. w. of Perry, 13 May 1941, *Wilmot & Murrill* (FLA). WAKULLA CO.: Wakulla Springs, *Correll* 5670 (DU); St. Marks, Apr. 1843, *Rugel* (MBG, NY). COUNTY NOT DETERMINED: *Baldwin* (PA); *Chapman* (MBG, NY, PA, US), 158 (NY); 1875, *Curtiss* (US); 1872, *Powell* (US); 1842-1849, *Rugel* (US); *Ware* (PA).

ALABAMA.—LEE CO.: Auburn, *Earle & Baker* 1583 (NY, US). MACON CO.: *Earle & Earle* 12 (G, MBG, ND, NY, US). MOBILE CO.: Mobile, *Graves* 1242 (MBG, US), 1878, *Mobr* (PA), and 1 May 1888, and 14 Apr. 1898 (US). MORGAN CO.: 10 mi. below Decatur, *Svenson* 7418 (G); Decatur, *Woodson & Anderson* 1552 (MBG). RUSSELL CO.: 8.3 mi. n. e. of Seale, *Hubricht* B1990 (MBG). TUSCALOOSA CO.: Tuscaloosa, *Nevius* (G). COUNTY NOT DETERMINED: *Buckley* (G); *Lavender* 16 (PA).

MISSISSIPPI.—HARRISON CO.: Biloxi, *Earle* 2023 (FM, NY), *Lloyd & Tracy* 13 (NY),

Tracy 4983 (MBG, NY, US). JACKSON CO.: Ocean Springs, Pollard 1078 (G), 29 Aug. 1895, *Sheehan* (MBG, US), and Tracy 1078 (MBG, ND, NY, US). COUNTY NOT DETERMINED: May 1859, *Hilgard* (MBG).

LOUISIANA.—AVOYELLES PAR.: Marksville, McAtee 2179 (US). CALCASIEU PAR.: Lake Charles, Allison 208, 212 (US); 5 mi. n. of Lake Charles, Correll & Correll 9655 (DU); Lake Charles, Mackenzie 511 (MBG). CATAHOULA PAR.: Sicily Island, Peck (PA). EAST BATON ROUGE PAR.: Baton Rouge, May 1858, collector unknown (NY). JEFFERSON PAR.: Gretna, Ball 364 (G, MBG, NY, US). ORLEANS PAR.: New Orleans, Drummond 2 (NY). OUACHITA PAR.: Monroe, 13 Apr. 1901, Trelease (MBG). PLAQUEMINES PAR.: 1 June 1885, Langlois (UP); Pointe a la Hache, 3 Apr. 1888, Langlois (ND), 2 (FM), and June 1880 (ND), 3 Apr. 1884, and Sept. 1884 (UM); Hermitage, Aug. 1882, Langlois (NY). RAPIDES PAR.: Alexandria, Hale (NY). ST. LANDRY PAR.: Melville, Bush 56 (MBG, NY, UM, US). ST. MARY PAR.: Morgan City, Correll & Correll 9340 (DU). ST. TAMMANY PAR.: Covington, Anect 46 (US), and Arsène 11016, 11966 (US). TANGIPAHOA PAR.: 1 mi. w. of Robert, Correll & Correll 10542 (DU). TERREBONNE PAR.: Terrebonne, 20 Aug. 1913, Wurzlów (NY). PARISH NOT DETERMINED: Carpenter (PA).

KENTUCKY.—HICKMAN CO.: Columbus, Palmer 15067 (MBG).

TENNESSEE.—HAYWOOD CO.: Shepherd, Palmer 17471 (MBG, US). LAKE CO.: Reelfoot Lake, Bain 380 (G, NY). OBION CO.: Reelfoot Lake, Moore B30 (MBG).

ILLINOIS.—ALEXANDER CO.: Cache, Palmer 15049 (MBG, US). PULASKI CO.: Wetaug, Anderson & Woodson 57 (MBG). ST. CLAIR CO.: Silver Creek, June 1824, Engelmann (MBG).

MISSOURI.—BUTLER CO.: Neelyville, Bush 34 (G, MBG, NY), 2540 (G, MBG, US); 19 Aug. 1892, Eggert (G); Poplar Bluff, 7 July 1893, Eggert (MBG); Smith 638 (FM). DUNKLIN CO.: Senath, Anderson & Woodson 32 (MBG); Campbell, 11 Sept. 1893, Bush (MBG), 10 (MBG, NY); Pine City, Bush 1 (MBG); Blue Spring, 19 Aug. 1892 and 6 May 1893, Eggert (MBG). PEMISCOT CO.: 3 mi. s. w. of Deering, Steyermark 5132 (FM, MBG). PULASKI CO.: 26 Apr. 1886, Hasse (NY). RIPLEY CO.: Naylor, Kellogg 26193B, 26193 (ND); between Naylor and Torch, Palmer & Steyermark 41606 (MBG); 3 mi. s. of Naylor, Steyermark 26600, 26601 (FM).

ARKANSAS.—CHICOT CO.: Eudora, Demaree 20948 (MBG, NY). CLAY CO.: Moark, Bush 2578 (MBG). CRAIGHEAD CO.: Cache River, Demaree 4298 (MBG). CRITTENDEN CO.: West Memphis, Demaree 11360 (MBG). HEMPSTEAD CO.: Fulton, Bush 208, 2446 (MBG); Fulton, Canby (PA). JACKSON CO.: Newport, Demaree 16978 (MBG, NY, UM), and 23 Apr. 1896, Eggert (FM, MBG, US), 7 May 1884, Letterman (MBG, US), Palmer 29756 (G), 35535 (MBG). LAWRENCE CO.: Minturn, 31 May 1939, Anderson (MBG); Portia, Wheeler 25, 26 (FM). MILLER CO.: between Homan and Mandeville, 10 June 1898, Eggert (MBG), and 19 June 1898 (NY); Texarkana, 16 Apr. 1901, Trelease (MBG). POINSETT CO.: 0.5 mi. n. of Waldenburg, Lodewyck 249 (DU, MBG, US). PULASKI CO.: Little Rock, June 1883, Hasse (DU); Scott, Moore 330081 (NY). COUNTY NOT DETERMINED: Halbert, Benke 4718 (FM).

TEXAS.—BEXAR CO.: Swearingen Ranch, Schulz 48 (US). BOWIE CO.: Texarkana, Palmer 22439 (MBG, US). BRAZORIA CO.: Columbia, Bush 1284 (NY, US); 3.5 mi. e. of Angleton, Cory 11468 (G, TAM); Rom, Palmer 13129 (MBG); Alvin, Tracy 9225 (G, MBG, NY, TEX, UM, UP, US). BREWSTER CO.: Marsh 324 (FM). DALLAS CO.: Dallas, Aug. 1882, Letterman (US). FORT BEND CO.: Rosenberg, Pennell 5554 (NY, UP). GALVESTON CO.: 7.8 mi. n. of High Island, Parks & Cory 20141 (TAM). HARDIN CO.: 5 mi. s. e. of Village Mills, Parks & Cory 22061 (TAM); 10 Sept. 1937, Tharp (TEX). HARRIS CO.: Cypress City, Bell 779 (G, MBG); Genoa, Chandler 2016 (MBG); Houston, Fisher 5034 (US), 38110 (FM), and 6 Apr. 1872, Hall (FM, G, MBG, NY, US); Cedar Bayou, 2 Dec. 1918, Hanson (NY); Houston, Lindheimer 4 (MBG), Rose 4166 (US), and Thunrow 10 (US). HAYS CO.: San Marcos, June 1897, Stanfield (NY). JEFFERSON CO.: Beaumont, Benke 5365 (FM, UM), 15 Mar. 1931, Hooks & Reed (TEX), 25 May 1901, Long (TEX), July 1884, Nealley (G), Palmer 12729 (G, MBG), Reverchon 2919 (MBG), 3704, 3704A (G, MBG, US), 9 Sept. and 9 Oct. 1937, Tharp

(TEX). KINNEY CO.: Fort Clark, *Mearns 1428* (US). LIBERTY CO.: Dayton-Cleveland, 19 Apr. 1930, *Tbarp* (TEX); Dolen, *Young 1275* (TEX). MONTGOMERY CO.: 24 mi. n. of Houston, 26 May 1907, *Tburrow* (US). NEWTON CO.: 24.5 mi. n. w. of Deweyville, *Parks & Cory 22307* (TAM). ORANGE CO.: Orange, *Bray 59* (TEX, US), 11 Aug. 1880, *Letterman* (MBG, US), 4 Apr. 1931, *Wild Wood Club* (TEX). TARRANT CO.: *Ruth 288a* (G). TOM GREEN CO.: San Angelo, *Palmer 11152* (US). WEBB CO.: Laredo, 1879, *Palmer 7* (NY). COUNTY NOT DETERMINED: San Marcos, Oct., *Gregg* (MBG); Brazos, *Lindheimer 1* (MBG); *Lindheimer 4* (PA); Santiago, *Nealley 52* (G).

The great variability in leaflet outline, particularly in width, does not appear to permit the recognition of any clear-cut varietal or specific segregates, although species and varieties founded on leaf characters have been described. This is especially so since the width of leaflets appears to vary considerably on different parts of one plant. This species appears to be more closely related to *C. Viticella* L., of southern Europe and Asia Minor, than to any American species of the section. As has been indicated above, the writer is of the opinion that the European species should be included in the section VIORNA.

### Subsection 3. INTEGRIFOLIAE

Erect, suffrutescent plants, simple or sometimes much branched. Leaves simple, broad, usually entire. Flowers solitary at the ends of branches, nodding, relatively small. Achene-bodies relatively small, not conspicuously rimmed. Achene-tails plumose or naked. Spp. 11-14a.

11. *Clematis ochroleuca* Ait. Hort. Kew. 2:260. 1789; James in Jour. Cincin. Soc. Nat. Hist. 6:120. 1883; Gray, Syn. Fl. N. Am. 1:7. 1895; Britt. & Br. Ill. Fl. 2:69. 1897; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908.

*C. sericea* Michx. Fl. Bor.-Am. 1:319. 1803; not HBK. in DC. Syst. 1:144. 1818.

*C. uniflora* Balbis, Cat. Hort. Taur. 21. 1810, *nomen nudum*.

*C. ovata* Pursh, Fl. Am. Sept. 2:736. 1814; not T. & G. Fl. N. Am. 1:8. 1838; nor Britt. ex Vail in Mem. Torr. Bot. Club 2:29, footnote. 1890; nor authors.

*C. ochroleuca* β. T. & G. Fl. N. Am. 1:7. 1838.

*C. integrifolia* a. *ochroleuca* Kuntze in Verh. Bot. Ver. Brandenb. 26:176. 1885.

*C. integrifolia* a. *ochroleuca* 2. *tomentosa* Kuntze, l. c.

*C. integrifolia* a. *ochroleuca* a. *parviflora* Kuntze, l. c. 177.

*C. integrifolia* a. *ochroleuca* b. *cylindrica* Vatke ex Kuntze, l. c.

*C. integrifolia* a. *ochroleuca* c. *crispiflora* Kuntze, l. c.

*C. integrifolia* a. *ochroleuca* d. *inciso-dentata* Kuntze, l. c.

*C. integrifolia* a. *ochroleuca* e. *subverticillata* Kuntze, l. c.

*C. integrifolia* β. *ovata* Kuntze, l. c., probably.

*C. integrifolia* β. *ovata* 2. *subglabra* Kuntze, l. c., probably.

*Viorna ochroleuca* Small, Fl. Southeast. U. S. 439, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:125. 1913; Small, Man. Southeast. Fl. 528. 1933, in part.

*Clematis ochroleuca* var. *ovata* Wherry in Jour. Wash. Acad. Sci. 21:195. 1931.

*C. ochroleuca* var. *sericea* Wherry, l. c. 197.

Stem erect, slender, simple or somewhat branched, 3–6 dm. high, 6-ribbed, tomentose, especially at the nodes; leaves 2–4 pairs on the primary stem, simple, subsessile, narrowly to broadly ovate, entire or rarely coarsely serrate, acute- or obtuse-tipped, those of the primary stem 6–12 cm. long, under-surface white-sericeous or tomentose when young, sometimes exceedingly so, glabrous or finely pubescent when mature; flowers solitary, terminal, nodding, narrowly urceolate, 1.5–2.5 cm. long; sepals linear-lanceolate, obtuse-tipped, narrow-margined and spreading at the tip, densely long-pubescent without; pedicels erect and elongated in fruit; achene-bodies suborbicular to fusiform, usually inequilateral, not strongly compressed, 3–4 mm. broad, narrow-rimmed, appressed-pilose above the middle; achene-tails 3–5 cm. long, plumose, light yellow or tawny, loosely intertwined or spreading.

DISTRIBUTION: sandy soil in the Piedmont region, from Staten Island, New York, to northern Georgia.

NEW YORK.—KINGS CO.: Brooklyn, May and July 1841, *Carey* (G, NY). RICHMOND CO.: Staten Island, 23 May 1864, *Allen* (FM, G, NY); New Dorp, 17 May 1884, *Britton* (FM), May and June 1887 (DU, FM, G, NY, UM, US), and various dates (FM, G, NY, PA, UP); Staten Island, May and July 1879, *Brown*, and 7 July 1895, *Cathcart* (US); Todt Hill, May 1870, *Congdon* (FM, US); New Dorp, May 1887, *Deane* (NY); Staten Island, July 1865, *Denslow* (PA), and 18 May 1915 (UP), 28 May 1864, *Eaton* (ND), 1871, *Gray* (MBG), 1867, *Hall* (MBG), 1871 (NY), 14 (MBG); New Dorp, 18 May 1889, *Hall* (FM); Natchogue, 1887, *Hollick* (NY); New Dorp, 12 May 1891, *Hulst* (UM); Grant City, 27 Aug. 1894, *Kearney* (FM, ND, NY), and 10 May 1895, *Lee* (NY); Staten Island, 1865, *Leggitt* (G); Grant City, 30 Apr. 1898, *Lewis* (NY); Staten Island, *Merriam* (PA); Todt Hill, 13 May 1894, *Pollard* (ND, US); Staten Island, *Redfield* (PA); Todt Hill, 12 May and 7 July, *Ruger* (MBG); New Dorp, 19 May 1883, *Schrenk* (ND), and 20 May 1887 (MBG); Grant City, *Svenson 6382* (ND); New Dorp, 27 May 1897, *Tyler* (MBG, UM, US); Grant City, 11 May 1895, *Van Sickle* (US).

DISTRICT OF COLUMBIA.—Washington, 13 May 1878, *Chickering* (FM, MBG, NY, UM), and July, *McCarthy* (FM); 21 Apr. 1897, and 1 Aug. 1898, *Steele* (G, NY, UM); Washington, 16 July 1884, *Ward* (G).

VIRGINIA.—ARLINGTON CO.: Alexandria, June 1866, *Curtis* (FM); Four Mile Run, *Dowell 6303* (FM, MBG), 20 June 1897, *Kearney* (NY, US), and *Painter 859* (MBG); Hunting Creek, *Painter 1251* (MBG); Naucks, *Pennell 2453* (PA, US); Arlington, May 1896, *Pollard* (NY); Four Mile Run, *Pollard 186* (ND, UM), 334 (G, NY, UM), *Ruth 51* (FM, NY), and 5 Aug., *Tidestrom* (US); Alexandria, May 1898, *Tidestrom* (ND). BOTETOURT CO.: Eagle Rock, 27 Apr. 1929, *Lewis* (PA). CHARLOTTE CO.: Keysville, *Baldwin 410* (G). CULPEPPER CO.: Mitchell Station, *Allard 2676* (G). DINWIDDIE CO.: e. of Burgess, *Fernald & Long 8271* (G), and 20 Apr. 1938, *Lewis* (G); Petersburg, *Tuomey* (PA). FAIRFAX CO.: Accotink, *Blake 9475* (G); Alexandria, 19 July 1873, *Carter* (PA); May 1866, *Curtis* (G); 1 mi. w. of Lorton, *Randolph & Randolph 143* (G); s. of Alexandria, *Smith 3054* (G); Sept. 1931, *Wherry* (PA, UP). FAUQUIER CO.: 4 mi. w. of Turnbull, 1 mi. w. of Buckland and 3 mi. s. e. of Warrenton, 25 May 1922, *Meredith* (PA); w. of Warrenton, *Tidestrom 6231* (G). FRANKLIN CO.: Bald Knob, *Wherry & Adams 2728* (UP). GOOCHLAND CO.: *Howell 748* (G). GREENESVILLE CO.: e. of Emporia, *Fernald & Long 7840* (G); Belfield, *Heller 906* (FM, G, MBG, ND, NY, PA, UM, UP, US). HENRICO CO.: Richmond, 25 July 1887, *Burk* (PA), May 1881, *Churchill* (MBG), and 5, 9, 13 May 1894 (G, MBG); Richmond, *DeChalmot* (US), and 20 July, *Univ. of Pa.* (UP). HENRY CO.: Martinsville, 14 Apr. 1938, *Eaton* (G). HIGHLAND CO.: Headwater, 30 May 1938, *Alexander* (NY). LUNENBURG CO.: Lunenburg, *Wherry & Pennell 14402* (PA). MECKLENBURG CO.: 6 mi. n. of Clarksville, *Fos-*

berg 15495 (UP). PRINCE WILLIAM CO.: Antioch, Allard 436 (G, NY). ROANOKE CO.: Roanoke, 16 May 1892, Britton & Vail (FM, NY, PA, US), 27 May 1892, Brown (G), Burnett (PA), 1868, Chapman (MBG), 1868, Churchill (MBG), and May 1892, Small (US); 5.3 mi. n.e. of Salem, 26 Apr. 1940, Wood (UP). SUSSEX CO.: Burt, Fernald & Long 6208 (G, NY, UP). COUNTY NOT DETERMINED: May 1832, Büschhoff (MBG); 1865, Glatfelter (MBG); Camp Humphries, McAtee 3337 (US).

NORTH CAROLINA.—ALAMANCE CO.: Graham, Biltmore Herb. 318b (US). BURKE CO.: Morganton, Canby 11669 (MBG). CALDWELL CO.: Lenoir, Biltmore Herb. 318d (US). DAVIE CO.: Farmington, Biltmore Herb. 318, 318a (US); Farmington, 9 May 1924, Knowlton (G). DURHAM CO.: Old Oxford Road, Anderson 6268 (FLA, PA); Durham, Blomquist 3638 (DU); Duke Univ. Campus, 14 May 1941, Gift (MBG). GRANVILLE CO.: Tar River, Correll 474 (DU, G). GUILFORD CO.: High Point, Biltmore Herb. 318c (UM, US), and June 1868, Canby (NY); Greensboro, Schallert 1093 (DU), Wiegand & Manning 1201 (G). HALIFAX CO.: Weldon, 19 Apr. 1908, Bartram (G, PA); Roanoke Rapids, 1904, Chase (DU); Weldon, 11 Apr. 1925, Murrill (FLA), Apr. 1897, Williamson (NY, PA), and 19 Apr. 1908 (UP). IREDELL CO.: Statesville, Hyams (FM, NY), May 1881 (UM), June 1898 (US). NEW HANOVER CO.: Wilmington, Henry 252 (UP). ORANGE CO.: Duke Forest, Blomquist 3636 (DU). PERSON CO.: n.w. of Roxboro, 16 Sept. 1934, Wherry (UP). RANDOLPH CO.: June 1895, Ashe (NY). ROWAN CO.: Salisbury, Curtis (PA); Salisbury, Heller 1 (FM, MBG, NY, PA, UM, UP); Heilig's Mill, 4-9 June 1891, Small & Heller (FM, G, UP, US). YADKIN CO.: Apr. 1882, Davis (UP). COUNTY NOT DETERMINED: Ashe (US); 1839, Curtis (US); 1841, Curtis (MBG); Hyams (US).

SOUTH CAROLINA.—ABBEVILLE CO.: Abbeville, Aug. 1898, Parcher (US), 1513 (UM). GEORGETOWN CO.: Georgetown, 18 May 1873, Schott (FM). COUNTY NOT DETERMINED: Durand (G).

GEORGIA.—DE KALB CO.: Stone Mtn., Ashe (NY). STEPHENS CO.: Toccoa, 7 Apr. 1930, Wherry (PA). COUNTY NOT DETERMINED: LeConte (NY).

There is a considerable range of variation in the degree of pubescence of the leaves in *C. ochroleuca*, but there is complete intergradation in this character; the writer has been unable to recognize any consistent geographical relation with pubescence (e. g. Henry 252 from Wilmington, N. C. is densely sericeous, although the more pubescent forms have been supposed to be characteristic of higher altitudes.) Since it is impossible to draw a definite line, it seems best not to recognize a variety *sericea*. A similar situation with regard to pubescence is found in *C. hirsutissima*.

12. *Clematis albicoma* Wherry in Jour. Wash. Acad. Sci. 21:198, fig. 1. 1931.

*C. ochroleuca* James in Jour. Cincin. Soc. Nat. Hist. 6:120. 1883, in part; Gray, Syn. Fl. N. Am. 1:7. 1895, in part.

*C. ovata* Britt. ex Vail in Mem. Torr. Bot. Club 2:29, footnote. 1890; Britt. & Br. Ill. Fl. 2:70. 1897; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908; not Pursh, Fl. Am. Sept. 2:736. 1814; nor T. & G. Fl. N. Am. 1:8. 1838.

*Viorna ovata* Small, Fl. Southeast. U. S. 439, 1331. 1903; Britt. & Br. Ill. Fl. ed. 2, 2:125. 1913.

*V. albicoma* Moldenke in Bull. Torr. Bot. Club 60:57. 1933.

*V. ochroleuca* Small, Man. Southeast. Fl. 528. 1933, in part.

Stem erect, slender, generally much branched, 6-angled, tomentose, especially near the nodes; leaves 2-4 pairs on the primary stem, usually narrowly ovate or

elliptic, entire, acute- to obtuse-tipped, those of the primary stem 5-9 cm. long, of the branches much smaller, glabrous or sparsely pubescent below, occasionally tomentose, moderately reticulate when mature; flowers solitary, terminal, narrowly urceolate, 1.5-2.0 cm. long; sepals linear-lanceolate, blunt-tipped, pale blue-purple at the base without, faint yellow toward the tips, sericeous; pedicels in fruit erect and not greatly elongate; achene-bodies suborbicular to inversely ovate, 3-4 mm. broad, not strongly compressed, narrow-rimmed, spreading-pilose above the middle; achene-tails 3-4 cm. long, plumose, pale yellow or whitish, loosely intertwined or spreading.

DISTRIBUTION: limited to shale barrens in the Alleghany Mountains of West Virginia and Virginia.

VIRGINIA.—ALLEGHANY CO.: 1.5 mi. w. of Covington, 8 June 1929, Wherry (NY), 10 June 1930 (PA), and w. of Covington, 7 June 1934 (UP). AUGUSTA CO.: Deerfield, Killip 30998 (US); 3.5 mi. n. e. of Deerfield, 16 July 1936, Wherry (UP). BATH CO.: Hot Springs, Hunnewell 4004 (G), 4763 (NY); Warm Springs, Moldenke 6811 (NY); 5 mi. n. w. of Mountain Grove, 14 June 1932, Wherry (DU, UP), State Line Mtn., 14 June 1932 (UP), and s. w. of Hot Springs, 10 June 1930 (PA). BOTE-TOURT CO.: Eagle Rock, 12 June 1933, Wherry (PA). CRAIG CO.: 0.5 mi. s. e. of Newcastle, Fogg 13255 (UP); 1 mi. w. of Craigs Creek, 12 June 1932, Wherry (UP). MONTGOMERY CO.: 1 mi. n. e. of Ironto, 12 June 1939, Wherry (UP).

WEST VIRGINIA.—GREENBRIER CO.: White Sulphur Springs, 19 Aug. 1890 and 16 May 1897, Britton (NY), and Brooks & Core 4732 (DU, PA, UM, UP); Kate's Mtn., 16 May 1892, Brown (NY), 22 July 1892 (G), 18 July 1940 (MBG), 16 June 1892, Brown & Small (NY, PA), Core 2708 (G), 4 Sept. 1920, Franklin (G), 22 May 1922 (UP), and Gilbert 511 (G); White Sulphur Springs, 13 July 1877, Guttenberg (US TYPE); Kate's Mtn., Heller 842, (FM, G, MBG, ND, NY, PA, UM, UP, US), and Hermann & Martin 951 (FM, G, MBG, PA, UP); White Sulphur Springs, Mackenzie 365 (MBG); Kate's Mtn., Martin & Erlanson 32 (DU); White Sulphur Springs, Moldenke 6876 (NY); Kate's Mtn., 16 May 1892, Small (FM, G, MBG, NY, PA, UM, UP, US), July 1892 (US), 5 Sept. 1936, Wills & Shunk (DU). MONROE CO.: Chocolate Drop, Berkley 1288 (MBG). PENDLETON CO.: Brandywine, Core 3662 (NY). COUNTY NOT DETERMINED: 1890, Coville (US).

The vicissitudes of Pursh's name, *C. ovata*, have been discussed in detail by Britton (1890) and Wherry. The writer has seen an impression of the type specimen of *C. ovata*, made by Dr. F. W. Pennell, and accepts Wherry's disposition of it. *C. albicoma* appears adequately set off from *C. ochroleuca* by its smaller leaves, more branching habit, and whitish achene-tails.

13. *Clematis viticaulis* Steele in Contr. U. S. Nat. Herb. 13:364. 1911; Wherry in Jour. Wash. Acad. Sci. 21:198. 1931.

A profusely branched shrub, 3-5 dm. high; branches slender, 6-angled, nearly glabrous; leaves numerous, simple, subsessile, lanceolate or narrowly ovate, entire, acute-tipped, 2-6 cm. long, essentially glabrous, moderately reticulate; flowers rather small, lavender; sepals glabrous or slightly pubescent without; pedicels erect in fruit, not exceeding the foliage; achene-bodies orbicular to fusiform, usually inequilateral, 3-4 mm. broad, scarcely compressed, rim not evident, finely appressed-pubescent above the middle; achene-tails 3 cm. long, plumose, reddish-brown, scarcely intertwined.

DISTRIBUTION: known only from the type locality, a shale barren in Bath Co., Virginia.

VIRGINIA.—BATH CO.: Millboro, *Adams & Wherry 2412* (UP), *2413* (US), *2414* (UP, US); Millboro, 14 Oct. 1933, *Alexander, Everett & Pearson* (NY), *Killip 32484* (G), 3 Sept. 1906, *Steele* (G, NY, UM, US TYPE), and 11 June 1930, *Wherry* (G, PA, UP); w. of Millboro, 7 June 1934, *Wherry* (MBG, UP).

This species is distinguished from *C. albicoma* and *C. ochroleuca*, its nearest relatives, by its much-branched habit, small leaves, and short, reddish-brown achene-tails.

14. *Clematis Fremontii* S. Wats. in Proc. Am. Acad. 10:339. 1875; Gray, Syn. Fl. N. Am. 1:7. 1895; Britt. & Br. Ill. Fl. 2:70. 1897; Britt. Man. 422. 1901; Gray, Man. ed. 7, 403. 1908.

*C. ochroleuca* var. *Fremontii* James in Jour. Cincin. Soc. Nat. Hist. 6:120. 1883.

*C. integrifolia* γ. *Fremontii* Kuntze in Verh. Bot. Ver. Brandenb. 26:177. 1885.

*Viorna Fremontii* Heller in Muhlenbergia 6:96. 1910; Britt. & Br. Ill. Fl. ed. 2, 2:125. 1913; Rydb. Fl. Prair. & Plains, 336. 1932.

Stem erect, stout, simple or somewhat branched, more or less villous-tomentose, especially at the nodes, 1.5–4.0 dm. high; leaves 3–5 pairs on the primary stem, simple, broadly ovate to nearly orbicular, sessile, obtuse-tipped, mucronate, entire or rarely very coarsely serrate, those of the primary stem 6–10 cm. long, essentially glabrous when mature, coriaceous and strongly reticulate; flowers solitary, terminal, nodding, narrowly urceolate; sepals narrowly lanceolate, about twice the length of the stamens, purple or pale blue-lavender without, fading to light green at the tips and within, glabrous to sparsely villous, with margins moderately expanded above the middle, tomentose; fruiting heads not exceeding the foliage; achene-bodies rotund to inversely ovate-rhombic, 5–6 mm. broad, densely tomentose at apex and at base of achene-tail, not greatly compressed, with a broad rim; achene-tails slender and tapering, 1–2 cm. long, but fragile and sometimes much shorter, glabrous above.

DISTRIBUTION: prairies, north-central Kansas and adjacent Nebraska.

NEBRASKA.—FRANKLIN CO.: Republican River, June 1939, collector unknown (NEB). NUCKOLLS CO.: Superior, 5 May 1929, *Bates* (NEB), and 10 May 1929, *Day* (NEB). WEBSTER CO.: Red Cloud, 5 June 1902 and 2 June 1909, *Bates* (NEB), and 20 May 1903, *Ducker* (NEB).

KANSAS.—CLAY CO.: Clay Center, 1933, *Masters* (KS). CLOUD CO.: *Fraser 279* (KS). ELLIS CO.: Saline River, *Albertson 12* (NEB); Ellis, 19 June 1888, *Bodin* (UM); 2 mi. w. of Hays, 18 Apr. 1937, *Bondy* (MBG, US), and *Erickson 514* (MBG); Ellis, *Gray* (FM); *Hitchcock 2* (G, KS, MBG, NY, US); 26 June 1885, *Kellerman* (KS, MBG); Hays, *Palmer 21311* (US); 2 mi. w. of Hays, *Runyon 27* (FM, UM); 3 mi. w. of Hays, *Rydb. & Imler* (KS, MBG, NY); 26 June 1885, "Sci. Exp." (KS); Ellis, *Watson* (NY, PA, UP, US), Oct. 1879 (FM), 1874, 1875, June 1883 (G), and 1875 (MBG). ELLSWORTH CO.: July 1895, *Hitchcock* (KS); summer 1892, *Underwood* (NY). JEWELL CO.: 1885, *Butts* (DU); Webber, summer 1894, *Dahl* (KS); Mankato, *Osborn 1014* (KS); Lovewell, *Tolstead 411337* (MBG). LINCOLN CO.: July 1895, *Hitchcock* (KS). MITCHELL CO.: Tipton, 31 Aug. 1920, *Augustin* (NEB); 19 May 1888, *Carleton* (KS, ND); s. of Beloit, *Gates 16490* (FM, KS). OSBORNE CO.: Alton, *Heber 144* (KS); 5 mi. from Osborne City, *Shear 231* (G, MBG, NEB, NY, US). OTTAWA CO.: Delphos, 7 Aug. 1935, *Cornelius* (KS). ROOKS CO.: Rockport, 30 Apr. 1889, *Bartholomew* (NY), 19 May 1889 (NEB), and 1890 (MBG); *Bartholomew 2a* (G,

KS, MBG, ND, NY, US); Stockton, 16 July 1908, *Bates* (NEB). SALINE CO.: 3 mi. w. s. w. of Brookville, *Hancin* 1735 (KS). COUNTY NOT DETERMINED: *Fremont* 194 (G TYPE, NY); *Gray* (MBG).

**14a. *Clematis Fremontii* var. *RiehlII* Erickson, n. var.<sup>24</sup>**

Stem 2.5–7.0 dm. high, usually much branched or rarely simple; leaves 3–6 pairs on the primary stem, elliptic-lanceolate to elliptic-ovate, obtuse- or acute-tipped, those of the primary stem 7–14 cm. long; fruiting heads equalling or slightly surmounting the foliage; otherwise as in the species.

DISTRIBUTION: on glades (dolomite or limestone barrens) in a restricted region of the Ozarks of Missouri.

MISSOURI—FRANKLIN CO.: Pacific, 1882, *Eggert* (MBG); Catawissa, 26 July 1887, *Eggert* (MBG, NY, US), 17 May 1891 (MBG), and 10 June 1891 (G, MBG); *Gray Summit* [introduced], *Greenman* 4883 (MBG); 15 May 1880, *Letterman* (MBG), 24 June 1880 (FM, MBG, PA, US), May 1882 (US), June 1882 (G), and 1887 (UP);

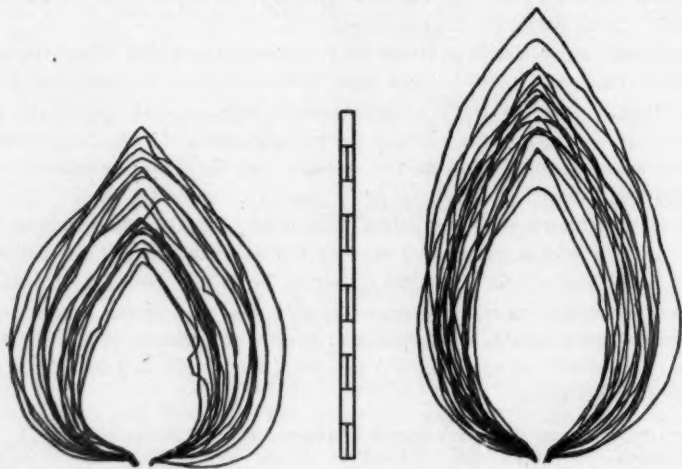


Fig. 6. Left, 20 leaf outlines from mass collection of *Clematis Fremontii* made 2 miles west of Hays, Ellis Co., Kansas (*Erickson* 514). Right, 20 leaf outlines from mass collection of *C. Fremontii* var. *RiehlII* made 2 miles southwest of Cedar Hill, Jefferson Co., Mo. (*Erickson* 548). Scale in centimeters.

"Morly," June 1883, *Letterman* (FM, MBG, PA, US), and 10 July 1884 (MBG, NY, US); Pacific, *Sherff* 966 (FM); 1.5 mi. w. of *Gray Summit* [introduced], *Steyermark* 1275 (MBG). JEFFERSON CO.: Hillsboro-DeSoto glade, 8 May 1937, *Chandler* (MBG); s. e. of Pacific, 16 May 1909, *Craig* (FM, MBG, NY); near Pacific, 3 Aug. 1886, 14 Apr. 1887, 11 May 1887 and 29 Apr. 1896, *Eggert* (MBG); DeSoto, 11 May 1896, *Eggert* (MBG, NY), and 27 June 1898 (MBG, NY, US); 2 mi. s. w. of Cedar Hill, *Erickson* 507, and 1.5 mi. s. of Morse Mill, 548 (MBG); DeSoto, 12 Apr. 1887, *Hasse* (FM, NY), 15 Apr. 1887 (MBG, NY), May 1887 (FM, G), and Apr. 1890 (UM); Victoria, 10 May 1890 and 8 July 1890, *Hitchcock* (MBG); *Dittmer*, *Kellogg* 1742, 15183 (MBG);

<sup>24</sup>Caules 2.5–7.0 dm. alti plerumque multo ramosi vel rare simplices; foliis elliptico-lanceolatis vel elliptico-ovatis obtusis vel acutis plerumque 7–14 cm. longis; caeterumque speciei similis.

*Mathias 832* (MBG); 0.5 mi. e. of Platin, *Ownbey 719* (MBG); Hillsboro, *Riehl* (MBG TYPE); Silica, 5 May 1898, *Russell* (MBG); between Local and House Springs, *Steyermark 1112* (MBG), and between Pevely and Sand Ridge, *2034* (FM); Victoria, 1 July 1891, *Webber* (NEB); 24 May 1885, *Wislizenus* (MBG). STE. GENEVIEVE CO.: 2 mi. n. of River aux Vases, *Steyermark 20926* (MBG). WASHINGTON CO.: Washington State Park, *Hubricht B2172* (MBG); Potosi, June 1846, *Riehl* (MBG). COUNTY NOT DETERMINED OR DOUBTFUL: 17 May and 10 June 1891, *Eggert* (US); *Eggert 63* (MBG); St. Louis, May 1924, *Epling* (MBG); Allenton, 10 May and 10 June 1880, *Kellogg* (MBG); Eureka, 10 Aug. 1889, *Kellogg* (MBG); Allenton, 10 June 1880, *Letterman* (FM, MBG, UM), 20 Apr. and 10 June 1887 (FM, G, UP), 30 July 1887 (UP), and 1893 (MBG, US); 15 May 1909, *Oblweiler* (MBG).

The difference in habit between this variety and the species proper is more striking than the measurements would indicate, and enables them to be distinguished readily. The Kansas plants present a very low, squat appearance, as compared with the more slender and open appearance of the variety *Riehl*. The complete geographical isolation of the two entities should also be noted.

Mass collections<sup>25</sup> of *C. Fremontii* and *C. Fremontii* var. *Riehl*, consisting of a single leaf from each of a number of plants, have been made at a locality in Kansas and at several in Missouri. Figure 6 shows tracings of leaf outlines from the Kansas collection and from one of the Missouri collections. The difference in leaf shape is evident and agrees with the impression one gains from a study of the herbarium material.

#### Subsection 4. BALDWINIANAE

Characters of the species. Sp. 15.

15. *Clematis Baldwinii* T. & G. Fl. N. Am. 1:8. 1838; James in Jour. Cincin. Soc. Nat. Hist. 6:119. 1883; Gray, Syn. Fl. N. Am. 1:7. 1895.

*Viorna Baldwinii* Small, Fl. Southeast. U. S. 439, 1331. 1903; and Man. Southeast. Fl. 528. 1933.

Stems simple or with 2 branches from the uppermost node, glabrous or slightly pubescent, slender; leaves usually only 1-3 pairs on primary stem, simple and ovate-lanceolate, or deeply cleft, the divisions narrowly linear, glabrous, veins inconspicuous; flowers 1-3, borne on very long pedicels, nodding, cylindrical-campanulate; sepals linear, blue or lavender, glabrous outside except the widely expanded crisped or undulate margins which are densely white-pubescent, tips widely spreading or recurved; pedicels erect in fruit; achene-bodies suborbicular to ovate, more or less symmetrical, rimmed, long-pubescent; achene-tails 6-8 cm. long, plumose, light yellow, widely spreading.

DISTRIBUTION: sandy soil, in the flatwoods of the peninsula of Florida.

FLORIDA.—BREVARD CO.: Merritt's Island, *Moldenke 217* (MBG, NY, UP); Rockledge, 3 Mar. 1928, *Roads* (MBG). DADE CO.: Gossmans, *Britton 161* (FM, NY); Nov. and Dec. 1903, *Eaton* (G); Homestead, *Eaton 651* (FM); Miami, June 1877, *Garber* (G); Goulds, *Moldenke 640* (MBG, NY, UP); *Rodbem* (PA); w. of Coconut Grove, *Small 8794* (NY), and s. w. of Cutler, *865* (NY, PA); between Perrine and Camp Jackson, Nov. 1903, *Small & Carter*, n. of Perrine, 16 Jan. 1909 (PA), and n. w. of Perrine, *2995* (NY); w. of Miami, *Small, Carter & Small 3245* (NY, PA); Murden

<sup>25</sup> Anderson in Ann. Mo. Bot. Gard. 28:287-292. 1941.

Hammock, *Small*, *Mosier & Small* 6413, Ross-Costello Hammock, 6564, Nixon-Lewis Hammock, 6866, and Timms Hammock, 6951 (NY); Camp Longview, *Small & Wilson* 1695 (FM, NY, UM); Biscayne Key, *Tatnall* 758 (PA); Silver Palm, *Young* 248 (US). DUVAL CO.: Mayport and Jacksonville, 1870 and 1876, *Keeler* (NY). FLAGLER CO.: 5 mi. e. of Seville, 24 May 1940, *Murrill* (MBG). HENDRY CO.: Goodno, *Eyles* 6819 (G). HERNANDO CO.: June and July 1898, *Hitchcock* (FM, MBG). HIGHLANDS CO.: Sebring, *Howell* 1054 (US). HILLSBOROUGH CO.: 10 mi. n. of Tampa, *Blanton* 6983 (MBG, ND, US); w. of Tampa, 30 Mar. 1923, *Churchill* (G, MBG); *Fredholm* 6500 (G); Fort Dade, June, *Leavenworth* (NY, PA); Tampa Bay, Mar. 1886, *Goode* (US), and 1837, *Hulse* (NY TYPE). INDIAN RIVER CO.: Fellsmere, *Small* 8895 (NY). LAKE CO.: Hawk-insville, 13 Mar. 1910, *Hood* (MBG); Eustis, *Nash* 559 (G, NY, US). LEE CO.: Alva, *Francis* 85 (US); Caloosa, 1 Apr. 1904, *Hovey* (G); Owanita, 18 Mar. 1907, *Kellogg* (G); Fort Myers, Apr. 1916, *Standley* (US), 67, 110 (FM, G, MBG, NY, US), 12607 (US), 57631, 73492 (FM); Fort Myers, 1904, *Westgate* (FM). LEVY CO.: Rosewood, June 1876, *Garber* (NY, PA, US). MANATEE CO.: 16 Mar. 1887, *Köbler & Rotbrock* (FM); Manatee River, June 1845, *Rugel* (G, NY); Osprey, 15 Mar. 1904, *Smith* (PA, UM); Bradenton, 23 Mar. 1934, *Tisdale & Weber* (MBG); Sarasota, 9 Apr. 1941, *Vanderbilt* (NY); 7 Apr. 1887, *Webb* (FM, MBG, PA); Palmetto, 15 Mar. 1928, *Weber & Kelbert* (MBG); Bradenton, May 1924, *Wheeler* (FM). MARION CO.: Fort Dallas, 1859, *Cooper* (G, NY); 1.3 mi. s. of Ft. McCoy, *Hubricht* B1993 (MBG). MARTIN CO.: 20 mi. w. of Stuart, 13 Apr. 1930, *Wherry* (PA, UP). OKEECHOBEE CO.: Okeechobee, Mar. 1935, *Swallen* (US). ORANGE CO.: Orlando, *Curtiss* 3 (FM, G, MBG, ND, NY, PA, UM, US), Mar. 1881 (NY, PA), and 6763 (G, MBG, NY, UM, US); Lake Monroe, Mar. 1876, *Garber* (FM, NY, PA, US); Winter Park, *Huger* 14 (MBG); Orlando, 1 Mar. 1927, *O'Neill* (MBG); March, *Patterson* (MBG); Orlando, *Rolfs* 58 (FM, MBG); 1889, *Vesterland* (US). OSCEOLA CO.: *Fredholm* 5792 (G, US). PALM BEACH CO.: w. of Jupiter, *Small et al.* 9233 (G). PASCO CO.: San Antonio, *Barnhart* 2704 (FM). PINELLAS CO.: Toytown, 10 Mar. 1926, *Williams* (PA), and Pasadena, 13 Apr. 1926 (MBG). POLK CO.: Fort Meade, 11 July 1922, *Armstrong & Armstrong* (MBG); Winter Haven, *McFarlin* 4466 (TEX); Fort Meade, 17 Mar. 1880, *Smith* (US). PUTNAM CO.: *Biltmore Herb.* 10731a (NY). ST. JOHNS CO.: St. Augustine, Apr. 1869, *Canby* (G, PA, US), and 10 Feb. 1876, *Smith* (US). SARASOTA CO.: Sarasota, *Tracy* 6746 (FM, G, MBG, NY, UM, US). SEMINOLE CO.: Sanford, 22 Oct. 1892, *Leeds* (FM), and 13 July 1895, *Williamson* (PA). VOLUSIA CO.: Seville, *Curtiss* 6755 (G, MBG, NY, PA, UM, US); Haw Creek Prairie, 28 Mar. 1882, *Mobr* (US); DeLand, Mar. and Apr. 1918, *Perkins* (G); Port Orange, *Straub* 76, 145 (G); s. w. of New Smyrna, 11 Mar. 1923, *Wherry* (UP); *Wright* (FM). COUNTY NOT DETERMINED: *Baldwin* (NY, PA); *Buckley* (G, MBG); Indian River, 1874, *Palmer* (FM, G, MBG); Godden's Mission, 7 and 9 Mar. 1919, *Sheehan* (NY); *Simpson* 37 (NY, US); *Underwood* 2348 (NY).

#### Subsection 5. HIRSUTISSIMAE

Erect herbs, somewhat woody in age, simple, or somewhat branched. Leaves pinnately multifid to simply pinnate, the ultimate divisions usually narrow. Flowers quite large. Sepals comparatively thin, pale without, densely soft-pubescent. Achene-bodies small, not greatly compressed, narrow-rimmed. Spp. 16-18.

16. *Clematis hirsutissima* Pursh, Fl. Am. Sept. 2:385. 1814; Piper in Contr. U. S. Nat. Herb. 11 [Fl. Wash.]:266. 1906; Tidestr. in Contr. U. S. Nat. Herb. 25 [Fl. Utah & Nev.]:209. 1925.

*C. Douglasii* Hook. Fl. Bor.-Am. 1:1, pl. 1. 1829; James in Jour. Cincin. Soc. Nat. Hist. 6:119. 1883; Kuntze in Verh. Bot. Ver. Brandenb. 26:180. 1885; Gray, Syn. Fl. N. Am. 1:8. 1895; Howell, Fl. Northwest. Am. 9. 1897; Coulter.

& A. Nels. New Man. Rocky Mt. Bot. 197. 1909.

*C. Wyethii* Nutt. in Jour. Acad. Nat. Sci. Phila. 7:6. 1834.

*C. Douglasii* f. *pulsatilloides* Kuntze in Verh. Bot. Ver. Brandenb. 26:180. 1885.

*C. Douglasii* a. *normalis* Kuntze, l. c.

*C. Douglasii* a. *normalis* 2. *erectisepala* Kuntze, l. c.

*C. Douglasii* β. *Wyethii* Kuntze, l. c.

*C. Douglasii* γ. *Jonesii* Kuntze, l. c.

*C. Douglasii* var. *rosea* Ckll. in West Am. Sci. 5:5. 1888.

*Anemone patens* var. *hirsutissima* Hitchc. in Trans. Acad. Sci. St. Louis 5:482.

1891.

*Pulsatilla hirsutissima* Britt. in Ann. N. Y. Acad. Sci. 6:217. 1891.

*Anemone hirsutissima* MacMillan, Metasp. Minn. Valley, 239. 1892.

*Clematis Douglasii* var. *Bigelovii* Jones in Proc. Cal. Acad. II, 5:614. 1895,

in part.

*C. Bakeri* Greene in Pittonia 4:147. 1900.

*C. Jonesii* Rydb. in Bull. Torr. Bot. Club 29:153. 1902.

*C. eriophora* Rydb. l. c. 154; Coult. & A. Nels. New Man. Rocky Mt. Bot. 197. 1909; Tidestr. in Contr. U. S. Nat. Herb. 25 [Fl. Utah & Nev.]:209. 1925.

*Viorna hirsutissima* Heller in Muhlenbergia 1:40. 1904; Rydb. Fl. Rocky Mts. 291. 1917.

*V. Douglasii* Ckll. in Torreyia 4:58. 1904.

*V. Douglasii* mut. *rosea* Ckll. l. c.

*V. Bakeri* Rydb. Fl. Colo. 141. 1906; Woot. & Standl. Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915; Rydb. Fl. Rocky Mts. 291. 1917.

*V. Jonesii* Rydb. Fl. Colo. 141. 1906; Rydb. Fl. Rocky Mts. 292. 1917.

*V. eriophora* Rydb. Fl. Colo. 141. 1906; Woot. & Standl. Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915; Rydb. Fl. Rocky Mts. 292. 1917.

*V. Wyethii* Rydb. Fl. Rocky Mts. 292. 1917.

*Pulsatilla patens* subsp. *hirsutissima* Zámels in Acta Hort. Bot. Univ. Latv. 1:101. 1926.

*Clematis Scottii* var. *eriophora* Tidestr. Fl. Ariz. & N. Mex. 34. 1941.

Stems clustered, erect, 1.5–6.0 dm. high, unbranched or with 1–4 slender sterile branches; leaves 2–5 pairs, pinnate, with 7–13 bi-multifid leaflets, the ultimate divisions lanceolate to narrowly linear, 2 mm. or more in width, sometimes the lowest pair of leaves simple or nearly so, leaves densely pubescent to sparsely pilose when young, when mature nearly glabrous; flowers solitary at the ends of the stems, nodding, broadly cylindrical, base truncate, 2.5–4.0 cm. long; sepals broadly linear or slightly tapering, obtuse and slightly spreading at the tips, 1.5–2.0 times as long as the stamens, thickish but not leathery, glabrous and deep purple within, paler and densely hirsute without, margins somewhat expanded, tomentose; stamens with long filaments; pedicels erect in fruit and greatly elongate; achene-bodies broadly fusiform, inequilateral, 3–4 mm. broad, slightly

compressed laterally but without lateral depressions, rim not apparent, hirsute; achene-tails long, plumose, silvery-white to yellow or light brown, loosely intertwined or spreading.

DISTRIBUTION: in the Rocky Mountains and adjacent regions, from eastern Washington to northern New Mexico.

MONTANA.—BEAVERHEAD CO.: Lima, 14 July 1908, and Monida, 8 July 1909, *Jones* (PA); Lima, *Shear* 3394, 3426 (NY). CARBON CO.: Red Lodge, *Rose* 34 (US). CASCADE CO.: Belt Mtns., 25 Aug. 1882, *Canby* (US); Belt River Canyon, *Williams* 111 (US). FLATHEAD CO.: Pleasant Valley, 25-30 June 1871, *Allen* (PA, US), and 25-30 June 1871, *Hayden* (PA). GALLATIN CO.: Fort Ellis to Yellowstone River, 15-20 July 1871, *Adams* (US); Bridger Mtns., 27 May 1899, *Blankinship* (MBG, PC); Bozeman, 5 June 1899, *Blankinship* (NY), 6 May and 4 July 1905 (MBG, PA, PC), and Mt. Bridger, 5 July 1905 (US); Bozeman, 14 May 1905, *Flaherty* (US); Middle Creek, 7 May 1926, *Franklin* (US); Bozeman, 1907, *Hodgman* (G); Bridger Mtns., 1 June 1901, *Jones* (G, MBG, US); 10 mi. s. e. of Bozeman, 4 Aug. 1887, *Knowlton* (US); Bozeman, 15 June 1899, *Moore* (G); Bridger Mtns., *Rydberg & Bessey* 4096, 4100 (NY), 4097 (NY, US), and 9 June 1901, *Scheuber* (UM, US); Flathead Pass, *Scheuber* 323 (NY); n. of Bozeman, 29 May 1883, *Scribner* (G, ND, PA, UP, US). LAKE CO.: Jocko River, 15 July 1883, *Canby* (PA); Jocko Creek, *MacDougall* 283 (NY, US). LEWIS AND CLARK CO.: Helena, 6 June 1887, *Anderson* (UM), 6 (NY), May 1888, *Harper & Harper* (FM); Helena, June 1888, *Kelsey* (UM, US), May 1891 (FM, NY), and 25 May 1892 (NY, PC, UM); Helena, *Rydberg* 2651 (NY), and June 1921, *Wootton* (US). MADISON CO.: Madison Range, *Floodman* 465 (NY); M. Y. stage line, *Nelson & Nelson* 5449 (G, MBG, ND, NY, PC, UM, US); Pony, *Rydberg & Bessey* 4098 (NY), and Jack Creek Canyon 4101 (FM, NY). MISSOULA CO.: Missoula, *Hughes* 1121 (MBG); Evaro, 13 July 1909, *Jones* (PC); Blackfoot Valley, *Kirkwood* 1412 (G); Bonner, *Paulson* 29 (US). PARK CO.: Livingston, 10 May 1901, *Scheuber* (NY, US), 20 May 1901 (UM), and 25 June 1901 (US); 1901, *Scheuber* 65, 89 (NY). POWELL CO.: Clearwater Creek, 15 July 1883, *Canby* (G); Deer Lodge, June 1890, *Kelsey* (UM); MacDonald Pass, *Muenschner* 11486 (MBG); Sunset, 16 June 1901, *Scheuber* (US), 14 July 1901 (UM), and 252, 253 (NY). COUNTY NOT DETERMINED: Black Hawk, *Floodman* 466 (NY, US); 1887, *Knowlton* (US); 1889, *Tweedy* (US).

YELLOWSTONE NATIONAL PARK: Mammoth Hot Springs, May and July 1893, *Burglebaus* (FM, NY, UM, US), and May 1889, *Dewart* (DU, MBG, NY); Obsidia, June 1888, *Hall* (NY); Sept. 1906, *Hapeman* (MBG); Yellowstone Lake, 1871, *Hayden* (PA); Swan Lake Valley, 7 July 1888, *Knowlton* (US); Mammoth Hot Springs, 28 May 1902, *Mearns* (FM), 839 (NY, US), 861, 1460 (US), 1020 (UM, US), and Electric Park, 196 (US); Specimen Ridge, 22 July 1902, *Smith* (FM); East Fork, *Tweedy* 892 (US).

WYOMING.—ALBANY CO.: Laramie Hills, *Nelson* 9564 (G, MBG, NY, UM, US). BIG HORN CO.: Big Horn Mtns., 6 Aug. 1881, *Forwood* (US), 54 (G), and 20 June 1928, *Tborp* (PA); 10-15 mi. e. of Kane, *Williams & Williams* 3078 (G, MBG, NY); *Worthingley* 27, 99 (US). CARBON CO.: Hayden Forest, *Eggleston* 11226 (US); e. from Encampment, *Nelson & Nelson* 789 (MBG). JOHNSON CO.: Big Horn Mtns., 21 Aug. 1897, *Knight* (US), and *Tweedy* 3389 (NY). LARAMIE CO.: Horse Creek, *Nelson* 202 (MBG, NY, PA, PC, UM, US). LINCOLN CO.: 5 mi. e. of Afton, *Payson & Armstrong* 3365 (G, MBG, PA); La Barge, *Stevenson* 103 (US); Dead Man Peak, *Williams* 1298 (MBG); Shoshone Canyon, *Wiegand et al.* 942 (FM); Beartooth Butte, *Williams & Williams* 3666 (MBG, ND, NY). SHERIDAN CO.: Wolf, *Cary* 725 (US); 19 mi. w. of Dayton, *Rollins* 475 (G, MBG, ND, NY); headwaters of Tongue River, *Tweedy* 171 (NY); Big Horn Mtns., *Tweedy* 2406 (NY). SUBLETTE CO.: Wind River Mtns., 21 July 1881, *Forwood* (US). TETON CO.: Teton Range, 24 July 1872, *Coulter* (PA, US); Gros Ventres Fork, 10 June 1860, *Hayden* (MBG); Teton Pass, *Williams* 779 (G, MBG, ND, NY), 6 mi. w. of Jackson, 1081 (MBG), and Black Tail Butte, 1747 (MBG); 0.5 mi. e. of Moose, *Williams & Williams* 2163 (G, MBG, ND). UINTEA CO.: Carter, 25

June 1896, *Jones* (PC); Fort Bridger, Aug. 1872, *Leidy* (PA); s. of Evanston, *Pammel & Blackwood* 4028 (G). WASHAKIE CO.: Middle Fork of Powder River, *Gooding* 295 (G, MBG, NY, PC, US). COUNTY NOT DETERMINED: "Horn Mtns.," *Cary* 35 (US); *Leckie, Merrill & Wilcox* 760 (G, NY, US); 1894, *Nelson* (ND); Platte Canyon, *Nelson* 8355 (RM); 1873, *Parry* (FM, G, MBG, NY, PA).

COLORADO.—ARCHULETA CO.: Pagosa, May 1883, *Brandege* (NY); e. of Durango, 29 June 1907, *Clements* (NY); Pagosa Springs, *Smith* 8 (PA). BOULDER CO.: *Orodel, Daniels* 998 (MBG); Boulder, *Patterson* 168 (G, MBG, NY, UM, UP, US). CLEAR CREEK CO.: Brookvale, 11, 15, and 24 June 1918, *Churchill* (G, MBG), and 21 June 1918 (MBG); Georgetown, 1885, *Patterson* (FM). CONEJOS CO.: Los Pinos, May 1899, *Baker* (MBG, NY). COSTILLA CO.: La Veta Pass, *Stone* 611 (NY). DELTA CO.: Delta, *Nelson* 147 (NY). EAGLE CO.: White River Forest, *Eggleston* 10826 (US). EL PASO CO.: Manitou, 30 Aug. 1936, *Alexander & Crehan* (NY); Ute Pass, *Biltmore Herb.* 1992b (US), and *Brandege* 911 (MBG); Colorado Springs, *Jones* 24 (NY, PA, PC, US); Ute Pass, *Letterman* 106 (US), and 4-5 Aug. 1884 (MBG); Pike's Peak, *Livingston* 186 (DU); Colorado Springs, *Rydberg & Vreeland* 6232 (NY); Ute Pass, 29 June 1886, *Trelease* (MBG); Cascade, *Walker* (FM); Pike's Peak, *Wiegand & Upton* 3242 (MBG, NY); Colorado Springs, *Williamson* (PA). GARFIELD CO.: Stuart Creek, *Graham* 9725 (MBG). GRAND CO.: headwaters of Clear Creek, 1861, *Parry* 82 (G, MBG, PA). GUNNISON CO.: Gate View, 5 June 1895, *Drant* (US). HUERFANO CO.: La Veta Pass, *McKelvey* 4803 (UM). JEFFERSON CO.: Evergreen, *Cletus* 98 (FM); Bear Creek Canyon, *Clokey* 3050 (G, MBG, TEX, US); Golden City, May 1871, *Greene* (NY), and Bear Creek, 22 July 1889 (ND); Bear Creek Canyon, 25 June 1937, *Knowlton* (G); Golden City, Aug. 1871, *Meehan* (PA); 3 mi. w. of Bergen Park, 17 June 1937, *Wherry* (UP). LA PLATA CO.: between Parrott City and Hesperus, *Baker, Earle & Tracy* 916 (FM, MBG, ND, NY, UM, US); Durango, *Eastwood* 5367 (G, US), and *Nelson* 10442 (NY); Hesperus, *Pennell* 21463 (PA); Durango, 5 July 1935, *Zobel* (MBG). LARIMER CO.: Estes, *Allen* 26 (MBG); 5 mi. w. of Fort Collins, 20 May 1893, *Baker* (NY, PC, UM), and w. of Fort Collins, 7 May 1896 (MBG, ND, NY); Estes Park, 29 May 1873, *Coulter* (FM, PA); 5 May 1896, *Crandall* (MBG), 8 (US), 10 (G, NY), 272 (NY), w. of Dixon Canyon, 334 (FM, NY, US), Horsetooth Gulch, 338 (G, NY, UM), and Howe's Gulch, 1379 (NY); Howes, 5 July 1895, *Earle* (FM); Camp Creek, *Gooding* 1454 (G, MBG, NY, US); w. of Fort Collins, *Mathias* 372 (MBG); between Loveland and Estes Park, 29 Aug. 1898, *Moyer* (UM); June 1894, *Osterhout* (UM), and 25 Apr. 1895 (MBG, UM). LAS ANIMAS CO.: between Raton Pass and Trinidad, *McKelvey* 2440A (US). MESA CO.: Fruita, *Pennell & Schaeffer* 22087 (PA). MONTEZUMA CO.: West Mancos River, 26 June, *Baker, Earle & Baker* (ND); Dolores, 15 June 1892, *Crandall* (NY), and *Payson* 1118 (MBG). MONTROSE CO.: Cimarron, *Baker* 29 (G, MBG, NY, UM, US), 138 (G, MBG, ND, NY, US); Tabeguache Basin, *Payson* 379 (FM, G, UM); Uncompahgre Plateau, *Tidestrom* 1563 (US). OURAY CO.: Ridgway, *Payson & Payson* 3844 (G), *Tidestrom* 2138, and *Tweedy* 263 (US); w. of Ouray, *Underwood & Selby* 175a (NY). PARK CO.: July 1905, *Williamson* (PA). RIO BLANCO CO.: Flag Creek, *Tidestrom* 1702 (US). ROUTT CO.: 5 mi. s. of Toponas, *Pennell & Schaeffer* 22321 (PA). SAN MIGUEL CO.: Iron Springs Mesa, *Walker* 527 (G, UM). COUNTY NOT DETERMINED: 1874, *Bradley* (ND); 11 May 1891, *Cowan* (US); Genesee Mtn., *Eastwood* 5452 (G, US); 1871, *Greene* (MBG); lat. 40°, 1862, *Hall* (PA); lat. 39°-41°, *Hall & Harbour* 2 (FM, G, MBG, NY, PA); 1870, *Hulse* (NY); Tongre Creek, *Purpus* 131 (FM); 1876, *Will* (PC); Clear Creek, *Wolf* 92 (NY, US); *Wolf & Rothrock* 92 (PA).

NEW MEXICO.—COLFAX CO.: Eagle Nest Lake, *McKelvey* 2411 (US); 19 mi. e. of Taos, *Wiegand & Upton* 3243 (MBG, NY); 1.5 mi. e. of Therma, *Wilkins* 2449 (US). LINCOLN CO.: Jicarilla, 1933, *Walcott* (US). RIO ARriba CO.: below Tierra Amarilla, *Eggleston* 6492 (G, MBG, NY, US); Chama, *Standley* 6782 (US). SAN JUAN CO.: Chuska Mtns., U. S. Geol. Survey 138 (G). SAN MIGUEL CO.: e. of Las Vegas, 2 June 1901, *Cockerell & Cockerell*, and between Las Vegas and San Ignacio, May, *Cockerell* (US); Las Vegas Hot Springs, 18 May 1902, *Sturgis* (G, NY). COUNTY NOT DETERMINED: Kern (PA); 1869, *Palmer* (PA).

ARIZONA.—COCONINO CO.: Grand Canyon National Park, July 1933, *McHenry* (US); Bright Angel, *Tidestrom* 2369 (US). MOHAVE CO.: Buckskin Mtns., *Jones* 6056y, and *Tidestrom* 2373 (US).

IDAHO.—ADA CO.: Boise, *Clark* 89 (FM, G, MBG, NY, PC, UM, US), and May 1881, *Wilcox* (G). BLAINE CO.: Ketchum, *Broadhead* (PC); 9 mi. n. of Ketchum, *Cronquist* 2416 (MBG); Ketchum, 23 June 1892, *Mulford* (MBG, NY, UM); Mt. Hyndman, *Tompson* 13614 (MBG, NY, PA). NOISE CO.: Centerville, *Johnson* (US); Dry Buck, *Macbride* 855 (FM, G, MBG, NY, PC, UM). CLARK CO.: Spencer, *Cronquist* 1280 (MBG), and n. w. of Kilgore, 1442 (MBG); Kilgore, *Rust* 766 (US); Beaver Canyon, *Rydberg* 2650 (NY), 13 July 1880, *Watson* (G), and *Shear* 3008, 3042 (NY). CUSTER CO.: Bonanza, *Smith* 31 (G). ELMORE CO.: Trinity, *Macbride* 589 (G, MBG). FREMONT CO.: Cave Falls, *Cronquist* 1746 (MBG); Buffalo River, *Jones* 5237 (G); Henry Lake, *Payson* & *Payson* 1967 (G, MBG, NY), and *Rydberg* & *Bessey* 4099 (G, NY). IDAHO CO.: "Camp Chopunnish," 27 May 1806, *Lewis* & *Clark*<sup>28</sup> (PA TYPE). KOOTENAI CO.: Lake Couer d'Alene, June and July 1892, (FM, UM); Santianne Creek, *Leiberg* 1057 (FM, G, NY, PC, US). LATAH CO.: Moscow, *Abrams* 542 (NY, PA), 6 May, 2 and 20 June 1894, *Henderson* (US), 20 Mar. 1928, *Siemens* (PA). NEZ PERCE CO.: Forest, *Brown* 5 (MBG, ND, NY, UM, US); Big Potlatch River, *McDougal* 320 (FM); June 1892, *Sandberg* (MBG), and Sept. 1892 (UM); Big Potlatch River, *Sandberg*, *MacDougal* & *Heller* 320 (FM, G, MBG, NY, US). WASHINGTON CO.: Middle Fork, *Weiser* River, *Jones* 6131 (MBG, PC), and Seven Devils Mtns., 6133 (PC); Payette National Forest, 8 June 1911, *Miles* (US). COUNTY NOT DETERMINED: Soldier Mtns., *Henderson* 3365 (US); *LeRoy* (NY); Cooper's Warm Springs, 20 July 1892, *Mulford* (MBG, NY).

UTAH.—CACHE CO.: Logan Canyon, *Mulford* 231 (MBG, NY). CARBON CO.: 10 mi. e. of Sunnyside, *Graham* 9537 (FM, G, MBG); Scofield, 24 June 1904, *Jones* (MBG, PC, US). DAGGETT CO.: 0.5 mi. w. of Green Lakes, *Hermann* 4876 (MBG), and *Williams* 597 (MBG, NY). DUCHESNE CO.: s. w. of Moon Lake, *Graham* 9314 (G, MBG). KANE CO.: Pahrpah, 1882, *Siler* (PA). SALT LAKE CO.: Little Cottonwood Canyon, *Garrett* 1384 (G), and Big Cottonwood Canyon, 1385 (US); Alta, 7 July 1910, *Jones* (PC, US), and *Rydberg* 6851, 6861a, 6862 (NY); s. e. of Silver Lake, *Rydberg* & *Carlton* 6432, 6453 (G, NY, US). SAN JUAN CO.: Abajo Mtns., *Goodman* & *Hitchcock* 1382 (FM, G, MBG, NY, PA, UM), 1476 (FM, MBG), and La Sal Mtns., 1476 (G, MBG, NY, PA, UM); Elk Ridge, *Maguire* & *Redd* 1796 (ND), and La Sal Ranger Station, 1801, (MBG); La Sal Mtns., *Purpus* 6626 (MBG, PC, US); Abajo Mtns., *Rydberg* & *Garrett* 9241 (NY, US). SAN PETE CO.: Wasatch Plateau, *Harris* C25797 (PA, UM), C25830 (UM), Ephraim Canyon, C26492 (UM), Ephraim Plateau, C27708 (MBG, UM), and Great Basin Experiment Station, C29580 (FM, UM); Wasatch Mtns., *Pennell* & *Schaeffer* 22734 (PA); Ephraim Canyon, *Tidestrom* 292, 1341 (US). SEVIER CO.: Fish Lake, *Dixon* 541 (FM); Fish Lake National Forest, *Eggleston* 10331 (US); Otter Creek Canyon, 17 July 1882, *Shook* (PC); s. of Glenwood, *Ward* 134 (FM, MBG, PA, US). UTAH CO.: Uintah Mtns., *Goodding* 1264 (G, MBG, NY, US); 15 mi. n. of Vernal, *Graham* 6308 (FM, MBG), Little Lake, 8243 (G, MBG), and Mosby Mtn., 8344 (MBG, US). UTAH CO.: Aspen Grove, *Garrett* 3374 (NY); American Fork Canyon, *Jones* 1351 (NY, US), and Soldier Summit, 5601b (US). WASATCH CO.: Horse Creek, *Graham* 9235 (FM, G, MBG). COUNTY NOT DETERMINED: Uintah Mtns., *Langille* 131 (US); American Fork Canyon, *Leonard* 122 (NY); Uintah Mtns., 19 July 1873, *Porter* (PA); Wasatch and Uintah Mtns., July 1869, *Watson* (G, NY, US).

WASHINGTON.—DOUGLAS CO.: Waterville, *Whited* 1211 (US). FERRY CO.: Hell Gate, *Pearall* 876 (NY). SPOKANE CO.: Spokane, May 1893, *Sandberg* & *Leiberg* (FM, UM), and Hangman Creek, 14 (G, MBG, NY, PA, US); Dishman, *Stillinger* 20 (US); 20 June 1884, *Suksdorf* (FM, NY, PA), 229 (G). WHITMAN CO.: s. of Pullman, 6 May 1928, *Bransford* (PA); Pullman, *Elmer* 1003 (UM, US), and 1570 (MBG), 17 July 1892, *Henderson* (NY, UM), *Jones* 1247, 1249 (G), and 9 June 1893, *Lake* (MBG); 5 mi. e. of Wawawai, *Maxton* 43 (MBG); w. of Colfax, *Parker* 348, 601 (UM); n. of

<sup>28</sup> Erickson in *Madroño* 6:259-260. 1942.

Pullman, *Pickett* 38 (UM), and Pullman, 271 (MBG); Pullman, 10 May 1893, *Piper* (UM), 19 May 1893 (G, MBG, NY), 1453 (G, NY, UM, US), and May 1901 (NY); Kaniak Butte, *St. John* 6073 (NY); Pullman, *St. John* 9615 (G, MBG, NY, PA), and *St. John & Parker* 5917 (G, MBG, NY); between Pullman and Armstrong, *Weber* 2036 (MBG); Pullman, 19 May 1893, *Williamson* (PA). COUNTY NOT DETERMINED: 1883, *Vasey* (US); *Wilkes* 556 (NY).

OREGON.—BAKER CO.: Baker City, 11 June 1902, *Jones* (PC), and Hereford, 25299 (MBG, PC). GRANT CO.: Austin, *Gale* 129 (G, MBG, US), and *Henderson* 5451 (G, MBG); 10 mi. n. of Seneca, *Thompson* 11922 (MBG, NY). HARNEY CO.: Emigrant Creek, *Peck* 3805 (FM). UMATILLA CO.: 8 mi. w. of Meacham, *Sherwood* 205 (FM); Kamela, *Heller* 10129 (FM, G, PA, US). WALLOWA CO.: Chico, *Jardine* 222 (US); 23 mi. above Imnaha, *Peck* 17622, and 22 mi. above Imnaha, 18121 (NY); Horse Creek, *Seldon* 8355 (NY, US). COUNTY NOT DETERMINED: Blue Mtns., *Cusick* 374 (FM), 1851 (FM, MBG, ND, UM, US), and 3232e (UM); Blue Mtns., *Douglas* (G, NY); *Geyer* 313 (G); Blue Mtns., 25 May 1885, *Howell* (FM, G, NY, PA, UM, US); Wenaha National Forest, *Lawrence* 139 (US); 1873, *Nevius* (G); Clear Water, *Spalding* (G).

The degree of pubescence of the young plants appears to show a general relation to latitude, plants from Washington and Oregon being densely hirsute, while in the southern part of the range they may be nearly glabrous. The variations in other characters, such as degree of division of the leaves and width of the ultimate divisions, show no evident geographical relationships; indeed there appears to be considerable variation within each colony, and aside from the variety *Scottii* with its simply pinnate leaves, and *arizonica* with its extremely filiform leaf-divisions, the writer is unable to recognize distinct varieties.

16a. *Clematis hirsutissima* var. *Scottii* (Porter) Erickson, n. comb.

*C. Scottii* Port. & Coult. Syn. Fl. Colo. 1. 1874; James in Jour. Cincin. Soc. Nat. Hist. 6:119. 1883; Kuntze in Verh. Bot. Ver. Brandenb. 26:179. 1885; Britt. & Br. Ill. Fl. 2:70. 1897; Howell, Fl. Northwest. Am. 9. 1897; Britt. Man. 422. 1901; Coult. & A. Nels. New Man. Rocky Mt. Bot. 198. 1909; Tidestr. Fl. Ariz. & N. Mex. 33. 1941.

*C. Douglasii* var. *Scottii* Coult. Man. Rocky Mt. Reg. 3. 1885; Gray, Syn. Fl. N. Am. 1:8. 1895.

*Viorna Scottii* Rydb. Fl. Colo. 141. 1906; Britt. & Br. Ill. Fl. ed. 2, 2:126. 1913; Woot. & Standl. Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915; Rydb. Fl. Rocky Mts. 291. 1917; Rydb. Fl. Prair. & Plains, 336. 1932.

*Clematis plattensis* A. Nels. in Bot. Gaz. 42:52. 1906; Coult. & A. Nels. New Man. Rocky Mt. Bot. 197. 1909.

Leaves 2-5 pairs on primary stem, pinnate, 5-11-foliate; leaflets simple or lobed, with distinct petiolules, lanceolate, sparsely pubescent; otherwise as in the species.

DISTRIBUTION: in the Bad Lands and Black Hills of South Dakota; and in the central and southern Rocky Mountain region.

SOUTH DAKOTA.—FALL RIVER CO.: 2 mi. n. of Hot Springs, *Barr* (MBG); Hot Springs, *Moore* 1183 (UM), and *Rydberg* 481 (G, NY, US). SHANNON CO.: Smithwick, 5 May 1941, *Barr* (MBG).

COLOZADO.—CHAFFEE CO.: Salida, *Payson* 1011 (MBG); Poncha Pass, *Ramaley & Johnson* 14939 (NY). COSTILLA CO.: La Veta Pass, 28 Aug. 1936, *Alexander & Creban*

(NY), Veta Pass, Hicks & Hicks 6 (DU, NY, UM), and 1877, Hooker & Gray (G); Sangre de Cristo valley, 1898, Horner (G); 1 mi. w. of Veta Pass, Ownbey 1383 (MBG, NY); Veta Pass, Shear 3605 (NY), 3672 (US). CUSTER CO.: base of Snowy Range, 24 July 1872, Redfield (MBG), 403 (PA); n. of Lock Mtn., Rollins 1230 (G, MBG, NY). FREMONT CO.: Cañon City, Brandegee 27 (MBG, PA), 1872 (NY), and June 1877 (FM); Parkdale, 1898, Horner (G); Cañon City, Nelson 10492 (MBG, NY, UP); 35 mi. w. of Cañon City, 27 July 1872, Porter (G, MBG, NY). HUERFANO CO.: Cuchara Camps, 18 Aug. 1923, McAllister (TEX); e. slope of La Veta Pass, McKelvey 4825, 4842 (UM); s. e. of La Veta, Rydberg & Vreeland 6230 (ND, NY), and 5 mi. s. w. of La Veta (NY). JACKSON CO.: Grizzly Creek, 26 July 1898, Baker (NY, PC). LA PLATA CO.: Ute Pass, 29 June 1886, Trelease (MBG). LAS ANIMAS CO.: 6 mi. s. of Trinidad, Beckwith 52, and Trinidad, 58 (NY); between Raton Pass and Trinidad, McKelvey 2440 (US); 26 mi. n. w. of Trinidad, Rollins 1807 (G, MBG, ND, NY). PUEBLO CO.: Greenhorn, Bethel, Willey & Clokey 4107 (FM, MBG, NY, PA, UM, US); Rye, Clokey 4108 (PA, US). SAGUACHE CO.: Alder, 17 June 1935, Ramaley & Johnson (TEX); 3 mi. s. e. of Poncha Pass, 8 Aug. 1937, Wherry (UP). COUNTY NOT DETERMINED: 1872, Brandegee (US); Arkansas Canyon, 1877, Hooker & Gray (G); Morton, 11 Sept. 1909, Rusby (NY); 1869, Seoville (US); Platte Canyon, 4 July 1885, Smith (PA).

NEW MEXICO.—COLFAX CO.: 10 mi. e. of Raton, McKelvey 2437 (US); top of Raton Pass, McKelvey 4891 (UM); Raton, Matthias 508 (MBG); Vermejo Park, St. John 177, and Aug. 1894 (G); Raton, Standley 6275, 13829, and Ute Park, 13987 (US); Raton, Tracy 50 (NY); 9 mi. w. of Cimarron, Wiegand & Upton 3245 (FM); Woolton, 3 June 1900, Williams (US). COUNTY NOT DETERMINED: 1867, Parry (MBG).

UTAH.—SALT LAKE CO.: above Alta, Rydberg 6861 (G).

Although there is a great deal of variation in the degree of compounding of the leaves and in the width of the ultimate divisions of the leaves in *C. hirsutissima*, this variety seems distinct from the species in having considerably wider leaflets and much less compound leaves.

16b. *Clematis hirsutissima* var. *arizonica* (Heller) Erickson, n. comb.

*C. arizonica* Heller in Bull. Torr. Bot. Club 26:547. 1899.

*Viorna arizonica* Heller in Muhlenbergia 1:40. 1904; Woot. & Standl. Contr.

U. S. Nat. Herb. 19[Fl. N. Mex.]:257. 1915.

*Clematis Bigelovii* var. *arizonica* Tidestr. Fl. Ariz. & N. Mex. 34. 1941.

Leaves 2-3 pairs on the primary stem, 2-3-pinnate, the ultimate divisions filiform, 1 mm. broad; otherwise as in the species.

DISTRIBUTION: in the region of Flagstaff, Arizona.

ARIZONA.—COCONINO CO.: Flagstaff, Fulton 7215 (US), and Hanson & Hanson A848 (MBG); 3 mi. e. of Flagstaff, Hanson 848 (US); Walnut Canyon, MacDougal 343 (G, NY TYPE, PA); Flagstaff, Osborn 7902 (US), and Purpus 19 (MBG, US). COUNTY NOT DETERMINED: de la Vergne Park, Aug. 1884, Lemmon (US).

This variety differs from the species also "in the rectangular instead of acute angled system of leaf branching," as Heller pointed out in his description.

17. *Clematis Palmeri* Rose in Contr. U. S. Nat. Herb. 1:118. 1891.

*C. Bigelovii* James in Jour. Cincin. Soc. Nat. Hist. 6:123. 1883, in part;

Tidestr. Fl. Ariz. & N. Mex. 34. 1941, in part.

*C. Douglasii* var. *Bigelovii* Jones in Proc. Cal. Acad. II, 5:614. 1895, in part.

*Viorna Palmeri* Woot. & Standl. in Contr. U. S. Nat. Herb. 16:123. 1913; and in Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915.

Stems erect, simple or few-branched, about 10 dm. high; rather stout and woody, red below, yellow above, somewhat pubescent, especially at the nodes; leaves 5-6 pairs, pinnate with 5-11 divisions which are 3-lobed or 3-foliolate; leaflets 3-5-lobed or coarsely toothed, 3-7 cm. long, ovate, obtuse- to acute-tipped, glabrous or with a few scattered hairs, sometimes slightly glaucous, thin, not evidently reticulate; flowers solitary at the ends of primary stems or axillary branches from the uppermost 1 or 2 nodes, large, 3-4 cm. long, resembling in all characters those of *C. hirsutissima*; pedicels not greatly elongate in fruit; achene-bodies obovate, 4-5 mm. broad, inconspicuously rimmed, covered with rather long, appressed pubescence; achene-tails 4-5 cm. long, plumose with weak, pale brown or tawny hairs, loosely intertwined.

DISTRIBUTION: western New Mexico and eastern Arizona.

NEW MEXICO.—GRANT CO.: s. end of Black Range, *Metcalfe* 42 (US). MC KINLEY CO.: Fort Wingate, 1883, *Matthews* (G). SANDOVAL CO.: Sandia Mtns., *Ellis* 18 (MBG, NY, US). SAN JUAN CO.: Tunitcha Mtns., *Standley* 7772 (US). COUNTY NOT DETERMINED: 1869, *Palmer* (US).

ARIZONA.—NAVAJO CO.: Fort Apache, 1890, *Palmer* 600 (G, US).

*C. Palmeri* resembles *C. hirsutissima* very strongly in characters of the flower and fruit, but appears worthy of specific distinction because of its more robust habit, broad leaflets and nearly complete lack of pubescence.

18. *Clematis Bigelovii* Torr. in Pacif. Rail. Rept. 4:61. 1856; James in Jour. Cincin. Soc. Nat. Hist. 6:123. 1883; Kuntze in Verh. Bot. Ver. Brandenb. 26:179. 1885; Tidestrom. Fl. Ariz. & N. Mex. 34. 1941, in part.

*C. Pitcheri* var. *Bigelovii* Robins. ex Gray, Syn. Fl. N. Am. 1:6. 1895.

*Viorna Bigelovii* Heller in Muhlenbergia 6:96. 1910; Woot. & Standl. in Contr. U. S. Nat. Herb. 19 [Fl. N. Mex.]:257. 1915.

Erect, simple or few-branched from the uppermost nodes, about 5 dm. high; stems slender, glabrous or nearly so; leaves 3-4 pairs on the primary stem, pinnate with 7-11 primary divisions which are deeply 3-lobed or 3-foliolate; leaflets usually 2-5-lobed, more or less broadly ovate, blunt- or round-tipped, mucronate, 1-3 cm. long, glabrous, somewhat glaucous below, thin, not conspicuously veined; flowers solitary, terminating primary stems or branches, subcampanulate, 1.5-2.5 cm. long; sepals equalling or slightly exceeding the stamens, broadly lanceolate, thickish, finely and sparsely pubescent without, except the tomentose, slightly expanded margins; achene-bodies suborbicular or obovate, 4-5 mm. broad, inconspicuously rimmed, appressed-pubescent; achene-tails about 3 cm. long, glabrous or somewhat pubescent, not plumose.

DISTRIBUTION: canyons, New Mexico and Arizona.

NEW MEXICO.—BERNALILLO CO.: Sandia Mtns., *Bigelow* 981 (G TYPE). GRANT CO.: Santa Rita del Cobre, 1877, *Greene* (G, ND); Silver City, 2 June 1880, *Greene* (FM), and June 1890 (PC); s. end of Black Range, *Metcalfe* 1044 (FM, G, MBG, NY, UM,

US). MCKINLEY CO.: Fort Wingate, May 1885, *Shufelt* (US). SOCORRO CO.: Bear Mtns., May 1881, *Rusby* (FM, MBG, NY, PA, UM, UP). COUNTY NOT DETERMINED: 1869, *Palmer* (G); *Torrey Herb.* (NY).

ARIZONA.—NAVAJO CO.: Fort Apache, May 1893, *Hoyt* (NY).

The position of this species is problematical. In habit and vegetative characters it appears closely related to *C. Palmeri*. However, it resembles *C. Pitcheri* in the appearance of its flowers and in its non-plumose and fragile achene-tails, and was regarded as a variety of *C. Pitcheri* by Robinson.

#### DOUBTFUL SPECIES

*Clematis roses* Smith in Abbot, Nat. Hist. Lepidopt. 201, *pl. 101*. 1797.

*C. striata* Rafinesque, Fl. Lud. 82. 1817.

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The numbers in parentheses are those assigned to species and varieties in this paper; those in *italics* are collector's numbers. The designation *s.n.* for unnumbered specimens has not been used except for species of which collectors have made both numbered and unnumbered collections.

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## EXPLANATION OF PLATE

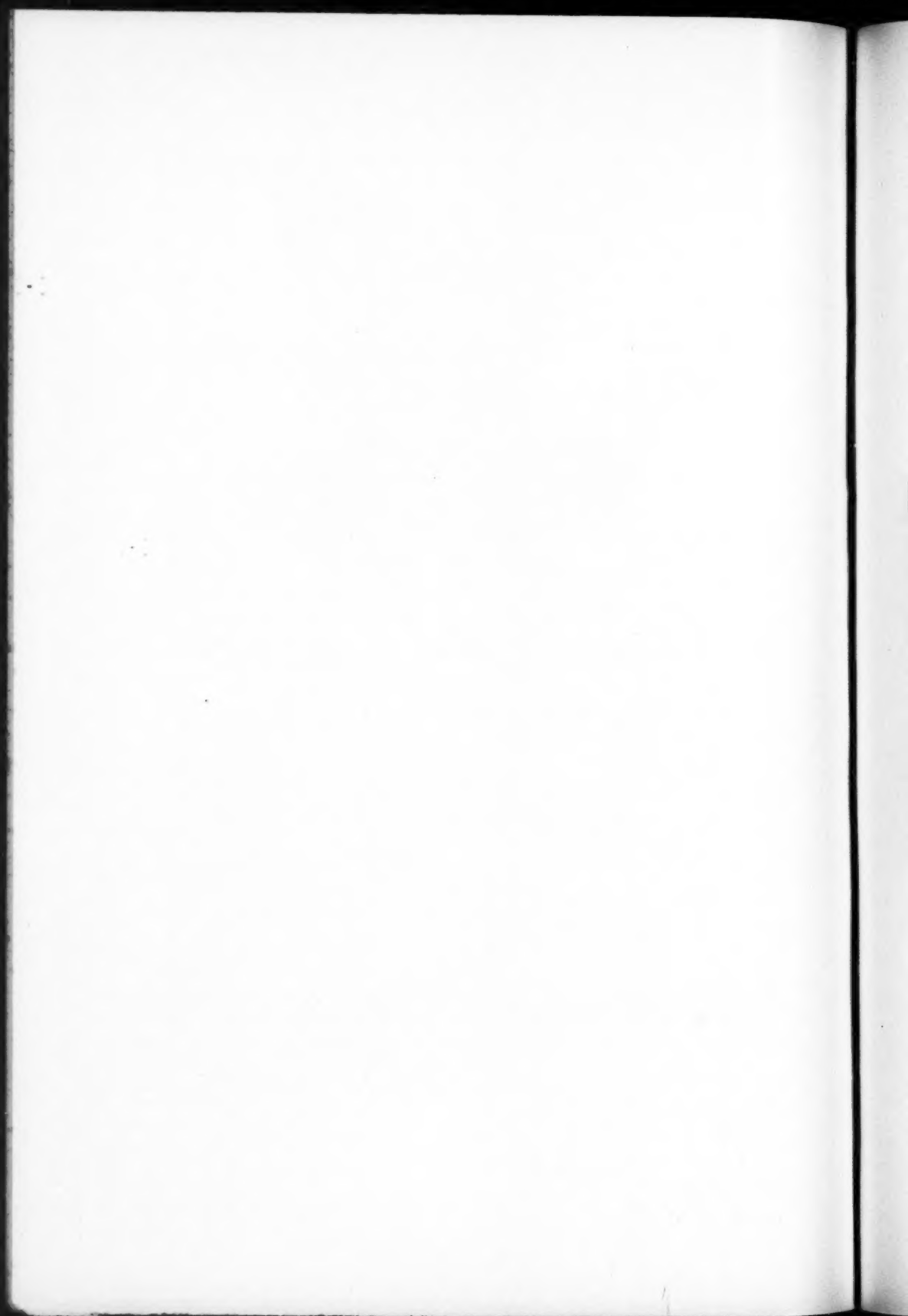
## PLATE I

*Clematis Fremontii* var. *Rieblii* Erickson

From type specimen in the Missouri Botanical Garden Herbarium. Label reads, "mining region of Missouri (about Hillsboro), N. Riehl, 1847."



ERICKSON—CLEMATIS SECTION VIORNA



POPULATION SIZE AND GEOGRAPHICAL DISTRIBUTION OF  
*CLEMATIS FREMONTII* VAR. *RIEHLII*

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Population size has very important bearings on evolutionary processes in any organism. As Dobzhansky (1941, p. 169) has pointed out, however, estimates of population size are available for only a few plants or animals. Among plants, the only such estimates are those of Anderson (1936) on *Iris*, and Emerson (1939) on *Oenothera organensis*. This paper presents detailed distributional data for *Clematis Fremontii* var. *Riehlü*, and a preliminary estimate of its population size.

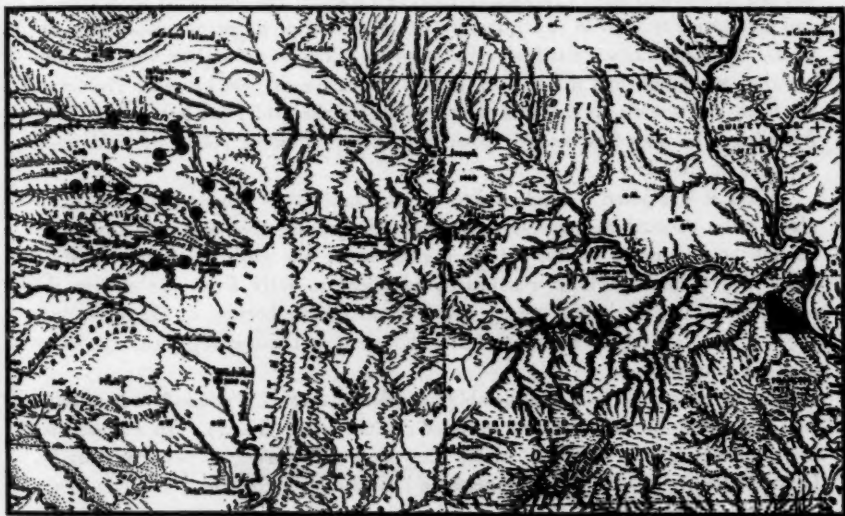


Fig. 1. Distribution of *Clematis Fremontii* (dots) and of *C. Fremontii* var. *Riehlü* (solid black). Base map by Erwin Raisz, reproduced from Atwood's 'Physiographic Provinces of North America', by permission of Ginn & Co.

*Clematis Fremontii* S. Wats., in its unrestricted sense, has a unique, disjunct distribution, being known from an area of roughly 10,000 square miles in north-central Kansas and adjacent Nebraska, and occurring again in eastern Missouri, where it is nearly limited to Jefferson County (fig. 1). A study of the available herbarium material has revealed some differences between the two branches of

the species. This point is discussed by Erickson (1943), and has been made the basis for proposing the name *C. Fremontii* var. *Rieblii* Erickson for the Missouri plants.

The limited range of *C. Fremontii* var. *Rieblii*, together with some other features of its distribution, and its vegetative characteristics, has recommended it for a detailed distribution study. It occurs exclusively on dolomitic glades, a well-marked type of habitat which has been described by Erickson, Brenner and Wraight (1942). The map which forms fig. 1 of that paper covers the range of *C. Fremontii* var. *Rieblii*, and was prepared as a preliminary to this study from tracings of aerial photographs. Fig. 2 of this paper is a reproduction of that map with the addition of the distribution data so far collected. The solid circles represent places in which *Clematis* has been seen. They have no numerical significance, some of them being based on finding of a single plant, others representing colonies of several thousand. The open circles are placed over glades on which *Clematis* has not been found after a reasonably thorough search. The plants are large enough and distinctive enough in appearance to be recognized at a distance of 200 or 300 yards. In many cases it has been possible to see *Clematis* on a glade without leaving the automobile, and it has been spotted by the use of field glasses. The leaves are thick and woody, so that the plants persist on the glades for over a year after flowering; this fact has made it possible to carry on some phases of field work throughout the year.

While it was often a simple matter to ascertain the presence of *Clematis* on a glade, more painstaking methods were used for the negative records. The plant has not been recorded as absent from a glade unless the glade has been visited on foot. For a small glade it was usually sufficient to walk from one end to the other; for a larger glade a zigzag course from top to bottom of the glade was followed, or two trips were made across it, one near the top edge, and the other near the bottom.

It can be stated with considerable confidence that *C. Fremontii* var. *Rieblii* does not occur outside the area outlined on the map (fig. 2). In Palmer and Steyermark's (1935, p. 542) catalog the plant is reported as occurring in St. Louis, Jefferson, Franklin, St. Francois and Washington counties. Its occurrence in Jefferson, Franklin and Washington counties has been repeatedly verified in this study. The St. Louis County record is undoubtedly based on the specimens collected by Letterman, labelled Allenton, and by Kellogg, labelled Allenton and Eureka (Erickson, 1943, p. 41). While the villages of Allenton and Eureka are in St. Louis County, the writer is convinced that the collections were made across the Meramec River in Jefferson County. An unsuccessful search has been made north of the Meramec, all along the outcrop of the Joachim formation, the only likely place. This view is supported by a half-dozen letters which Letterman wrote to Dr. Engelmann in the spring of 1875. It appears from these letters that Letterman had explored the southwestern part of St. Louis County quite thoroughly; and that he was on the look-out for the *Clematis*. On June 24 he states, "I do

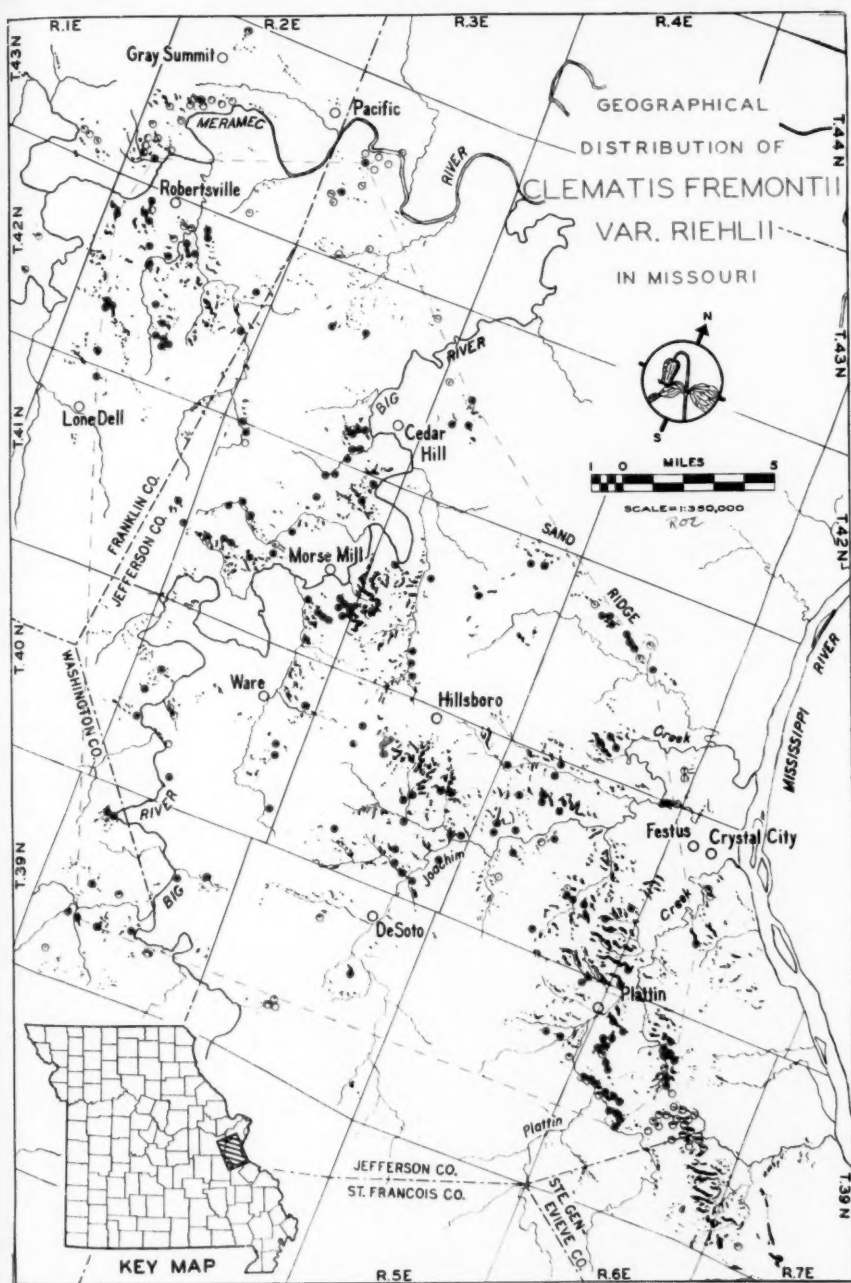


Fig. 2. Distribution of *Clematis fremontii* var. *riehlII*. Irregular black areas are glades; solid red circles, stations at which the plant has been seen; open red circles, glades on which *Clematis* has not been found after search.



Fig. 3. Mature plant of *Clematis Fremontii* var. *Rieblii* growing on glade shown below. Scale at right is in centimeters.



Fig. 4. Portion of glade 2 miles southwest of Robertsville, Franklin Co., Mo. (R.2E, T.42N, S.7, N.W.¼), showing plants of *Clematis Fremontii* var. *Rieblii* in foreground. Photographs taken April 27, 1942.

not remember having seen the *Clematis* [undoubtedly *C. Fremontii* var. *Rieblii*] in any of my rambles." He was fond of crossing the Meramec at Hunter's Ford and collecting in Jefferson County; and he later found the plant, his collections bearing various dates from 1880 to 1893. Kellogg's St. Louis County collections are probably to be interpreted in the same way.

The St. Francois County record does not appear to be supported by any herbarium specimen; *Clematis* has not been found on several glades in St. Francois County which have been visited in the course of this study. Steyermark has apparently collected the plant in Ste. Genevieve County.<sup>1</sup> It has not been possible to verify this record although three visits have been made to Beckett Hills for that purpose. Unsuccessful search has also been made for the *Clematis* in a number of other scattered localities which lie outside the area of the map.

Of the 160-odd positive records plotted in fig. 2, about 15 occur in places where no glades are indicated. In all of these cases the *Clematis* was found on glades which are quite small and were overlooked in tracing the photographs. The error arising from failure to investigate other unrecorded small glades is much less than the ratio of 15 to 160, because of the small numbers of plants on such glades as compared with the large numbers represented by many of the other dots.

The area occupied by the *Clematis* was outlined on the map (fig. 2) by connecting outlying dots with straight lines. By weighing a paper cut-out of the resulting polygon, the area was found to measure 436 square miles. For R.3E, T.41N, S.1-18, the total area in glades was measured by placing the photo tracings over a piece of paper ruled in small squares and counting the squares covered by the glade outlines. In these 18 square miles, the glade area is 1.6 percent of the total area. Assuming this percentage to be characteristic of the entire range of the *Clematis*, the glades on which it occurs occupy a total area of 7.0 square miles.

A few population density counts have been made. On a glade in R.6E, T.39N, S.4, 2½ miles east of Plattin, 1067 plants were counted in an area of 0.865 acre, a density of 794,000 plants per square mile of glade. In R.2E, T.42N, S.10, 2 miles southeast of Robertsville, 578 plants were counted in 2.33 acres, about three-fourths of a small glade. This represents a density of 160,000 plants per square mile of glade. Multiplied by 7.0 square miles, these densities give values for the total population of 5,550,000 and 1,120,000 respectively. The true value probably lies nearer the lower number.

In R.3E, T.41N, S.25, southeast of Morse Mill, the total number of plants was estimated as 5040. Ten-foot strips were laid out at 250-foot intervals across all the glades in the section, the plants were counted in these strips, and the estimate for the entire square mile was made from this sampling. Multiplying 5040 by 436 square miles gives 2,200,000 as the total population of *C. Fremontii* var. *Rieblii*, a

<sup>1</sup> The specimens are labelled: *Clematis Fremontii* Wats., limestone glade in Beckett Hills, 2 mi. north of River aux Vases, Ste. Genevieve Co., No. 20926, Oct. 31, 1936, Julian A. Steyermark, Collector.

result which is of the same order of magnitude as the two estimates given above, although it was arrived at by a somewhat different method.

The absolute size of a population, however, does not have much meaning. Much more significant in evolutionary phenomena is Wright's "population number," the effective size of the breeding population (Dobzhansky, 1941). A number of factors besides absolute frequency are involved in the population number, such as (for this *Clematis*) size and proximity of the colonies, longevity of the plants, pollination radius, means and rate of seed dispersal, etc. An attempt to evaluate some of these factors is being made, and it is hoped that they may be discussed in a later paper.

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## THE SEEDS OF TRADESCANTIA MICRANTHA

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*Tradescantia micrantha* Torrey is a curious, trailing, subsucculent species native to a small region in southeastern Texas. It is not closely allied to any other *Tradescantias* native to the United States but superficially at least it resembles *T. brachyphylla* of northeastern Mexico.

When the American species of *Tradescantia* were monographed<sup>1</sup> an unsuccessful attempt was made to obtain seeds of *T. micrantha*, since the size and shape of the seed and in particular the nature of the funicular scar has been found useful in delimiting natural groups of species. Thanks to the efforts of Mr. Robert Runyon, the well-known collector of Brownsville, Texas, seeds have at length



Fig. 1. Four seeds of *T. micrantha* greatly enlarged. Reading from the left, the first and third show the upper side of the seed, the second and fourth, the lower, the funicular scar being in the middle of the seed and extending vertically for about one-third the diameter in that direction.

(From photograph by Miss Eloise Pannell).

been obtained in quantity. Photographs showing the seeds greatly enlarged are reproduced in fig. 1. The seeds are broadly compressed-oblongoid to subtrigonal in shape, and the funicular scar, while linear, is less than half as long as the seed and may even appear subpunctate. Comparison with pl. VII of Anderson and Woodson's monograph<sup>1</sup> indicates a closer relationship to *T. Wrightii* than had previously been suspected. *Tradescantia brachyphylla*, on the other hand, is known to have very different seeds.<sup>2</sup> They are compressed subspherical with a funicular scar approximately as long as the seed. Any further discussion of the exact affinities of *Tradescantia micrantha* must await a general consideration of the whole problem, such as has recently been suggested by Woodson.<sup>3</sup>

<sup>1</sup> Anderson, E. and R. E. Woodson. Contr. Arnold Arb. 9. 1935.

<sup>2</sup> loc. cit. p. 29.

<sup>3</sup> Woodson, R. E. Ann. Mo. Bot. Gard. 29: p. 154. 1942.



## ENVIRONMENTAL AND GENETICAL VARIATIONS IN YIELD AND COLONY SIZE OF COMMERCIAL YEASTS<sup>1</sup>

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One essential requirement of a good commercial baker's yeast is the ability to transform the maximum amount of nutrients in the fermentor into yeast in the shortest possible time. Yeasts vary in this property, and our first step in an attempt at yeast improvement included the collection of various strains, and the design of adequate tests for selecting the high-yielding ones.

This yield test was designed primarily to reject inferior cultures. The early data are comparative and indicative rather than absolute. In handling hundreds of cultures in the laboratory it is not feasible to duplicate plant conditions, and yields of the same yeast are relatively lower in the test-tube than in the plant. Our ultimate objective is to devise a test which will predict accurately the behavior of a yeast under plant conditions.

### MEDIA AND METHODS

1. *The Yield Test.*—Broth was made by mixing carbohydrate and protein mashes obtained from the Anheuser-Busch yeast plant, in proportions which produced a medium about one half as concentrated as that used in the fermentors. This resulted in a medium containing 0.8 per cent sucrose and 0.7 per cent nitrogen-containing solids. It was neutralized by adding an excess of powdered calcium carbonate. After autoclaving for almost an hour to remove the heat-coagulable proteins, it was filtered with diatomaceous earth. A medium resembling that used commercially was designed to avoid the selection of strains of yeast not adapted to the ordinary commercial medium. Twenty cc. were placed in an 8 x 1-inch test-tube. This test-tube had previously received a small inverted gas tube, the lower opening of which was cut off at a slant to prevent a seal forming by contact with the base of the larger tube. After the tubes were autoclaved, approximately the same amount of inoculum was introduced into each tube with a spatulate needle. Within wide limits the amount of inoculum seems to make little difference in the yield. Twenty-four hours later the depth of the column of gas in the inverted tube was read to the nearest half centimeter. After 48 hours the contents were shaken up and 10 cc. were poured into a Hopkins vaccine tube and centrifuged for 20 minutes at 2000 r.p.m. The volume of the yeast was read off directly and recorded in hundredths of a cc. per 10 cc. of broth.

<sup>1</sup> This work was supported by a grant from Anheuser-Busch, Inc., St. Louis.

2. *MDY Agar*.—Our standard medium for plating yeasts is malt-dextrose-dried yeast agar of the following formula:

Malt extract	10.0%
Dextrose	.5%
Dried brewer's yeast	.5%
Agar	3.0%
CaCO <sub>3</sub>	1.0%

3. *CM Agar*.—Carbohydrate protein mash agar was made simply by adding 3 per cent agar and 1 per cent CaCO<sub>3</sub> to the broth used in the yield test.

4. *Pr Agar*.—Prune agar was made by diluting the syrup from canned prunes with an equal volume of tap water and adding 1 per cent CaCO<sub>3</sub> and 3 per cent agar.

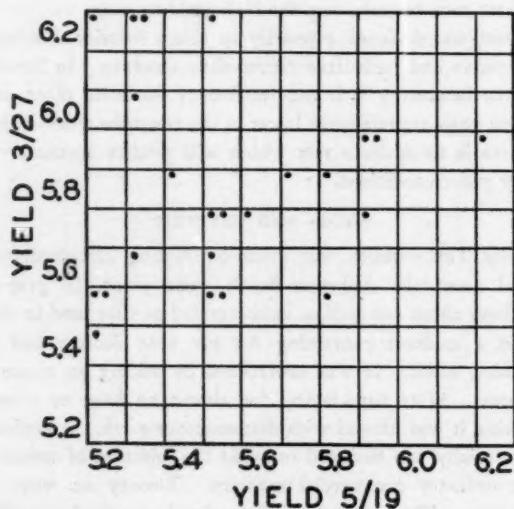


Fig. 1. Diagram showing correlation between yields of selected colony cultures in successive tests.

#### REPRODUCIBILITY OF DATA ON YIELD

A large number of duplicate tests with two different tubes of broth proved that the yields usually checked within .2 of a hundredth of a cc. when the tests were carried out at the same time. We have found on repeated trials that yeasts yielding less than 4.0 (hundredths of a cc.) usually remain in the low ranges and that those yielding 5.5 or more are not found in the lower brackets.

The data in fig. 1 show the yield of a group of different cultures tested on March 27, as compared with transfers from those cultures tested on May 19.

Although the correlation is not so high as might be desired, none of these relatively good yeasts was found on the second test to fall into the undesirable low-yielding category, i.e., in the ranges below 4.5. An interesting fact concerning the low-yielding yeasts is that the sediment in the centrifuge tube is usually much darker than that in the high-yielding ones.

#### PURIFICATION OF MIXTURES BY THE PLATING TECHNIQUE

Many yeasts are mixtures of genetically different kinds of cells which can be separated. The two principal techniques for effecting separation are (1) plating and (2) single-cell isolation. Cells are plated by spreading a loopful of a dilute suspension of the yeast over the surface of an agar plate. Individual colonies on the thinly seeded area of the plate usually originate from single cells. Single colony selection is more fruitful than single-cell isolation in separating mixtures, for it is possible to examine and compare several hundred colonies by spreading only a few plates. Colonies differing in shape and topography, selected from a plate and spread in turn on other plates, are generally found to repeat their respective characters, indicating that the original colonies were pure. The colonies must be rather well spaced if this technique is to be successful. The second method of single-cell isolation requires the selection of individual yeast cells with a micromanipulator. This is not at all difficult with yeast cells but plating yields so much more abundant results that it is the preferred method. In an unpublished study of variations of bacteria we made over 300 single-cell isolations of a bacterium with a relatively high mutation rate and found that plating gave results consistent with those obtained by single-cell isolations. Most bacteriologists studying variation agree with this conclusion.

#### HETEROGENEITY OF COMMERCIAL YEAST

Many commercial yeasts contain a heterogeneous mixture of biotypes, and this is especially true of old test-tube cultures. We recognize two general classes of colonies in these mixtures which we have called the primary and secondary types. The primary type usually seems to carry the desirable qualities. Various secondary genotypes are also present, but they are apparently deleterious rather than beneficial. Some of our data suggest that the commercial propagation of yeast considerably reduces the heterogeneity. The heterogeneity can be demonstrated by streaking on a rich substrate (such as MDY agar). The primary colonies from which the yeast derives its superior qualities are large, white, entire, smooth, hemispherical and opaque. The secondary colonies are generally much smaller than the primaries and are often brownish with lobed margins and rough surfaces (pl. 2, fig. a) or gray, translucent and flat (fig. b). Two typical small secondary colonies are also shown in pl. 3, fig. a. The secondary colonies often appear in a variety of types, indicating that they differ among themselves. The possibility that they may carry some valuable qualities seems unlikely for many

tests have revealed that these forms are extremely inferior in yield and fermentative ability. This view is further supported by the fact that most good commercial yeasts when fresh produce few secondary colonies. The secondary colonies sometimes have distinctive cell shapes. Rough colonies often have long, slender cells while smooth ones usually have ellipsoidal cells. However, there is much variation in cell size and shape in any colony. We have found a few extreme cases in which this character was very useful diagnostically.

#### AN EXAMPLE OF HETEROGENEITY IN A BAKERS' YEAST

A striking example of sharply bimodal heterogeneity in a bakers' yeast was discovered by plating a sample from a pound package of yeast. The colonies appearing in the plates shown in pl. 2, fig. b were of two kinds: typically large and opaque primary colonies, and flat, translucent, and gray secondary colonies. The cells of the primary colonies were of normal size, but those of the secondary colonies were generally small. Tests for yield revealed the following distribution:

<i>Yield class range</i>	<i>Primary colonies</i>	<i>Secondary colonies</i>
2.0-2.9	0	11
3.0-3.9	0	1
4.0-4.9	0	0
5.0-5.9	0	0
6.0-6.9	11	0
7.0-7.9	3	0

The two types of colonies appeared in about equal numbers on the plate, indicating that about half the package was made up of a distinctly inferior yeast. This is the only heterogeneous yeast which we have found containing two such sharply contrasted forms. More frequently a wide range of variation is encountered.

#### SELECTION WITHIN A CLONE

An attempt was made to determine if the primary colonies can be further subdivided into yeasts of high and low yield. The results are recorded graphically in fig. 2. On the horizontal scale are indicated the various class ranges in yield of hundredths cc. per 10 cc. of medium. On May 31 a commercial live dried yeast was plated on MDY agar and 16 large colonies selected and tested for yield. Thirteen colonies plated from the lowest-yielding culture (6.3) were tested on June 6a. On the same day (June 6b) 12 colonies originating from one of the highest-yielding colonies were tested, but no significant differences were revealed. This suggests that the primary colonies of the commercial yeast are all closely related genetically.

In any colony there are rather wide variations in cell size. Not unusually small colonies which produce poor yields contain an excess of small cells. An effort was made to determine if large and small cells from one colony produced high- and low-yielding cultures. On June 8, 6 single-cell cultures were made of

the large cells, and 4 single-cell cultures of small cells from the same high-yielding culture. No significant difference was found between these two groups, indicating that the variations in cell size are not necessarily indicative of genetical differences.

On June 10 tests a and b revealed that the highest- and lowest-yielding cultures from June 6a did not produce significantly different types. Also the c and d tests showed that the highest- and lowest-yielding colonies from June 6b did not result in differently yielding progenies. Finally, on June 15, 14 colonies selected from the highest-yielding colony in the June 10d test were found to be not significantly better than the original colonies.

Throughout the record, it is clear that the day on which the tests were made, rather than the yield of the parent culture, affected the determination of the mode. The lowest-yielding group was obtained on June 10, the next on June 6, June 8, and June 15, and the highest-yielding group on May 31. Since the tests were made at room temperature, because of limitation of incubator space, it appears that if more accurate duplication were desired, it would be necessary to incubate the tubes. As has already been pointed out, the tests are only to eliminate inferior stocks, and while accurate temperature control is desirable it is not essential. Although temperature probably determines the position of the mode, the variation about the mode is apparently due to other local environmental conditions.

In the course of the experiment, 10 small secondary colonies were selected from various plates and tested along with the primary colonies. The two histograms (fig. 2b) show that most of these secondary colonies are distinctly inferior in yield. Secondaries were not present on all plates and when present usually made up less than 1 per cent of the total number.

In one series of selections the highest-yielding member of each set was successively chosen to produce the next culture generation. Selections were made serially from the following populations (a) May 31, (b) June 6b, (c) June 10d and (d) June 15. This intensive selection did not result in any improvement of the culture, indicating that the primary colonies all belong to one biotype.

Variation due to environmental differences usually have a range of from 0.5 to 1.0 hundredths of a cc. in a 10-cc. sample at any given temperature of incubation. The use of class ranges with a magnitude of .5 and the fact that all the samples usually fell in three classes make the environmental variations look much larger than was actually the case. The few samples in the outer ranges usually fell close to the central class. With many yeasts we have found that a dozen or more samples from one plate may all fall within a range of .2 hundredths of a cc. The yeast used in this experiment showed greater variations in a given determination than were usually encountered. This difference in the ranges of variability of different clones unfortunately means that a genetically significant variation in one yeast may not necessarily be significant in a second yeast.

It is clear that the secondary colonies yielding less than 5.0 are distinctly in-

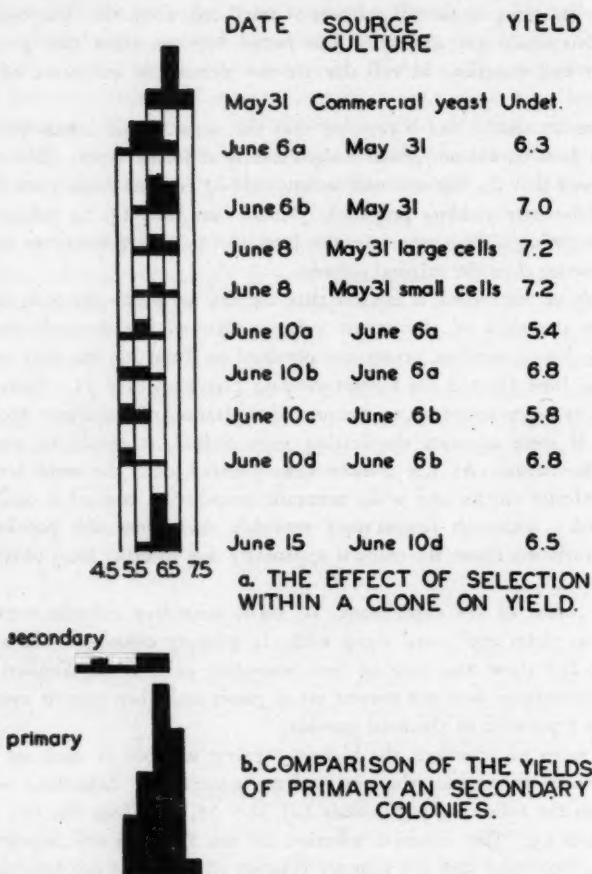


Fig. 2. Series of histograms showing the frequency of yield in a series of selections from a yeast clone. See text.

ferior yeasts. These secondary colonies probably arise by mutation or segregation. Segregation, however, must occur rather rarely since spore formation in these strains does not normally occur except under special conditions.

#### COLONY SIZE ON VARIOUS MEDIA

Roughness and smoothness or other characters affecting the topography and morphology of the colony are easily recognized as stable genetical characters which readily distinguish different strains or variants in yeasts. It is a great advantage to be able to plate out cultures on agar and observe the distribution of

these different types. Although all the colonies on an agar plate may be readily recognized as being either rough or smooth they are never all of the same size. When the colonies are plated thickly they are generally small, apparently because they interfere with each other. At the edge of the seeding, where only a few colonies appear, they are usually larger. This type of size variation is purely environmental and has no genetic basis. It can be seen very clearly in pl. 3, figs. a and e.

The true dwarf colonies, which we have called secondary colonies, can be detected merely by their small size if the test is made under the proper conditions. When colonies are planted thinly, these secondary colonies remain small when compared to the primaries. Since the secondary colonies have been found to yield considerably less than the primaries, it is an especial advantage to be able to form some opinion of the distribution of primary and secondary forms in a culture merely by inspection of the colonies on an agar plate.

On a poor medium the situation is quite different. At the first transfer to a poor medium there may be no correlation between size of colony and yield. Fewer colonies appear following equal inoculation on a poor agar than on a rich medium, and the colonies that do grow vary greatly in size. The fact that the number of colonies is reduced proves that only a small fraction of the cells survive transfer to the inferior medium. Plate 3, figs. a, b, and c show agar plates on which equal numbers of cells were plated on MDY agar (pl. 3, fig. a), on CM agar (pl. 3, fig. b) and on Pr agar (pl. 3, fig. c). On the latter two media only a few colonies appeared, and they varied greatly in size. Twenty-four colonies on a CM agar plate were graded according to size, "A" indicating the largest and "F" the smallest size class. They were tested for yield with the results shown below.

Yield class range	Colony Size					
	Largest					Smallest
	A	B	C	D	E	F
4.5-4.9		1				1
5.0-5.4	1		3	1	2	
5.5-5.9		1	1	4	2	3
6.0-6.4					3	1

The four highest yielding cultures were obtained from colonies falling in the two smallest size categories. These results show that the differences in colony size on a poor medium do not result from true genetic differences in vigor. Only a few cells survive the shock of transplantation, and the surviving cells which are able to produce colonies do not fully recover from the shock of the transfer even after the colonies originating from the survivors have attained their full growth. However, a second transfer to the same medium makes the adaptation complete as far as can be judged from colony size.

Figure 3 is a record of variations in size of colonies after serial plating on CM, MDY, and Pr agar. Large, medium, and small colonies selected from CM plates, like those shown in pl. 3 fig. b, were transferred to CM medium. All produced

uniformly large colonies following this second transfer to the identical inferior medium, corroborating the view that the size differences shown on the first CM plate were not due to genetic differences in vigor. Transfer to MDY medium also produced uniformly large colonies. However, transfer from CM to Pr agar did not result in uniformity, but the plates made from large and small colonies both showed considerable variation in colony size. When large colonies from the first Pr plate were transferred to a second Pr plate only uniform large colonies appeared. Moreover, when the small colonies from the first Pr plate were transferred to a second Pr plate uniform large colonies resulted. This proves that transfer from CM to Pr produces shock just as transfer from MDY to either Pr or CM did. After two transfers on a specific poor medium, adaptation to this specific poor medium occurs which makes the culture capable of producing uniformly large colonies on the inferior substrate.

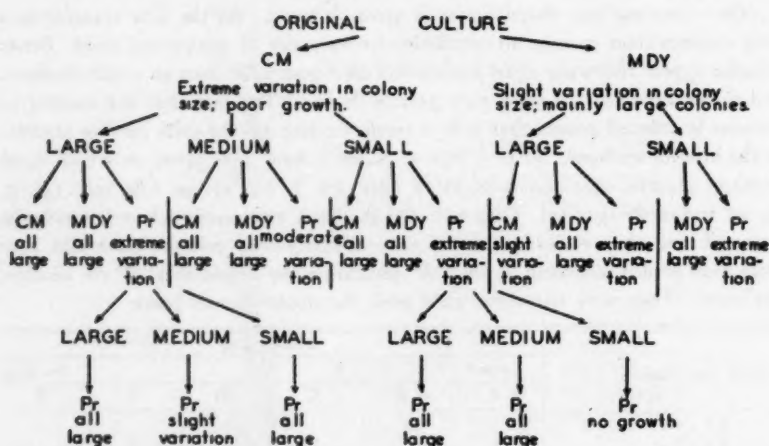


Fig. 3. Variations in colony size on MDY, CM, and Pr agars and the effects of selection of large and small colonies.

It is an especial advantage to be able to form some opinion of the distribution of primary and secondary forms in a culture simply by sowing an agar plate. However, primary and secondary colonies can only be distinguished when the culture is plated on a rich medium supplying all the necessary nutrients. Although one might expect that a medium lacking in certain essentials would be better adapted to making distinctions of this kind, on poor media there is so much reduction of size, probably due to the shock of the first transfer and from other causes, that the distinction fails. On the MDY medium two types are easily recognized. This does not imply that either the primary or secondary colonies are genetically uniform as a class. We have found in *Neurospora* that a good medium often con-

ceals minor genetical difference. The apparent difference between yeast colonies on a poor medium are artefacts.

These experiments prove that it is possible to distinguish high- from low-yielding yeasts by colony size provided a rich medium such as MDY is used. However, the potentially high-yielding cells do not necessarily produce the larger colonies when plated on inferior agar. One might expect that the differences between survivors after exposure to exceptionally adverse conditions would be due to true genetic differences, but it appears from these experiments that if the conditions are too severe the differences in colony size among the survivors is the result of a series of relatively unpredictable accidents and not indicative of hereditary vigor.

#### THE EFFECT OF GENETIC DIFFERENCES ON SURVIVAL UNDER ADVERSE CONDITIONS

Plate 2, figs. a, b, and c show the colonies appearing when the R strain of yeast is sown for the first time on MDY, CM, and Pr agar respectively. This R strain (R does not signify "Rough" but is merely a serial designation) is an exceptionally good baking yeast with a rather low yield but high baking strength. Subsequent analysis has shown that it is probably a single ascospore culture. The significance of this fact will be discussed in later papers.

Plate 2, figs. d, e, and f show the colonies appearing when the D strain is sown for the first time on MDY, CM, and Pr agar. This strain yields relatively higher than the R strain but has less baking strength, i.e., it requires longer to cause bread to rise. Genetic analysis has shown these two strains to be distinctly different. It is apparent that this genetic difference results in a larger number of D strain cells surviving the transfer. In this strain there are also many fewer variations in colony size on both the CM and Pr agars, which is in line with the view that the variations in colony size are proportional to the severity to the shock of transfer.

#### SUMMARY

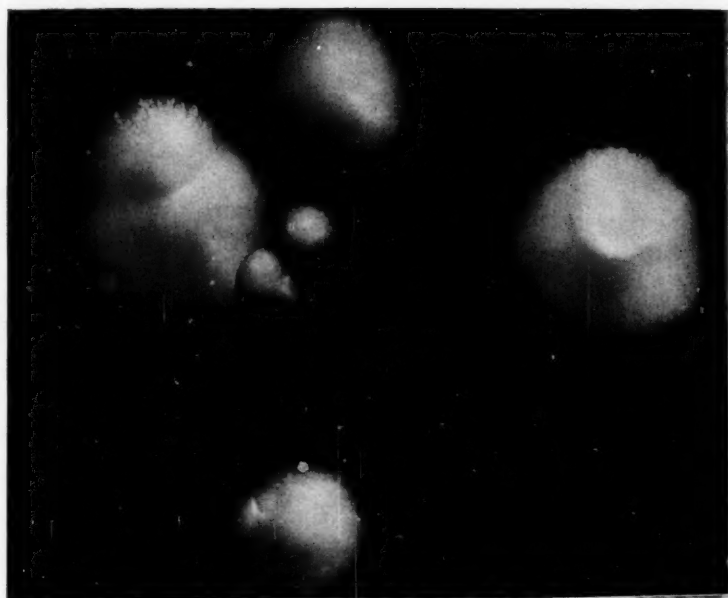
A test which indicates the efficiency of a yeast in transforming nutrient materials into yeast cells has been developed and its reliability studied. Many commercial yeasts were found to produce two classes of colonies when planted on a good medium. We have called the large smooth colonies, primary colonies, and the small variable colonies, secondary colonies. The secondary colonies are low yielders. The distinction between primary and secondary colonies fails when yeasts are planted on poor media because the shock of transfer causes great variation in colony size.

## EXPLANATION OF PLATE

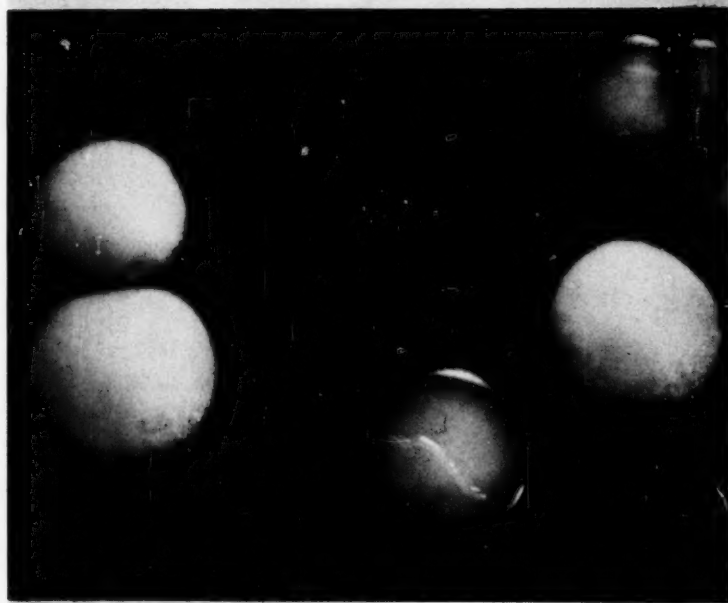
## PLATE 2

Fig. a. Typical large and smooth primary colonies with various small and rough secondary variants on MDY agar.

Fig. b. Large hemispherical white primary colonies and flat translucent gray low-yielding secondary colonies plated from a cake of commercial yeast.



a



b

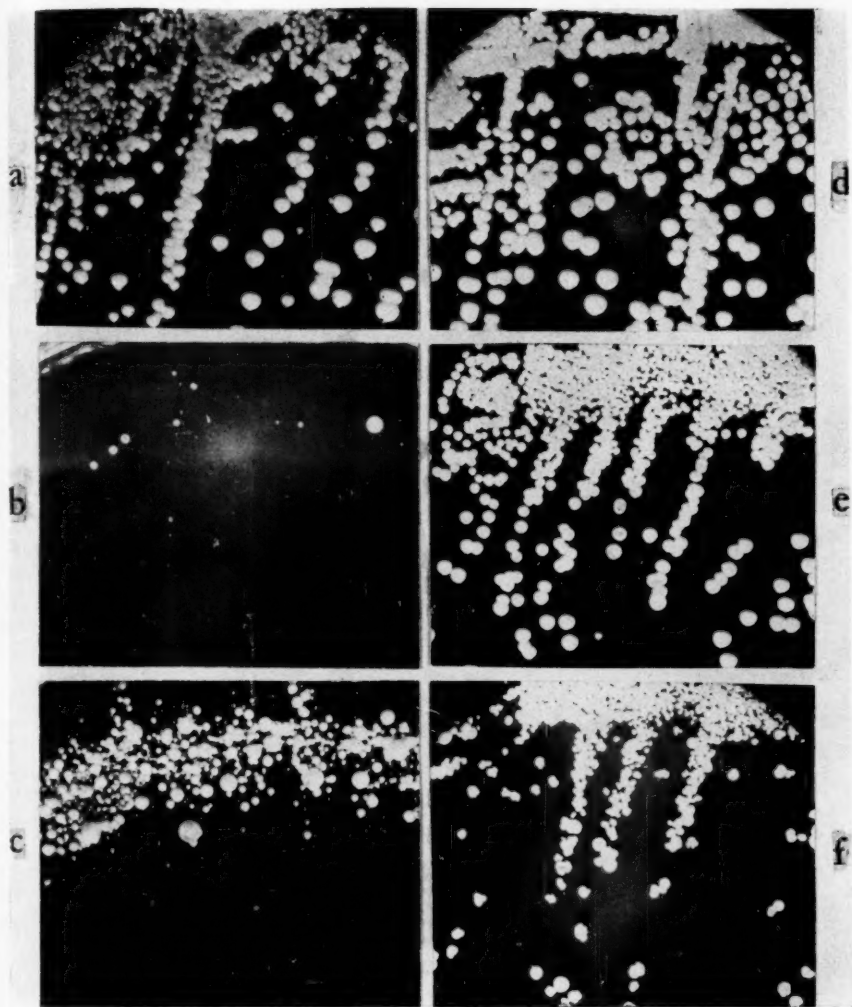
LINDEGREN & LINDEGREN—VARIATIONS IN YEASTS

## EXPLANATION OF PLATE

## PLATE 3

Figs. a, b and c. Colonies of the R strain of yeast appearing after plating equal number of cells on MDY (a), CM (b) and Pr (c) agars. Two true secondary colonies appear on the MDY plate. On the CM plate there is appearing a great reduction in the number of colonies and much variation in size. On this plate variations in size bear no relation to yield.

Figs. d, e and f. Colonies of the D strain of yeast appearing on MDY (d), CM (e) and Pr (f) agars. This yeast is genetically different from the R strains and withstands the shock of transfer much more successfully.



LINDEGREN & LINDEGREN—VARIATIONS IN YEASTS



CONTRIBUTIONS TOWARD A FLORA OF PANAMA<sup>1</sup>

VII. MISCELLANEOUS COLLECTIONS, CHIEFLY BY H. VON WEDEL,  
IN BOCAS DEL TORO

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BROMELIACEAE

(L. B. Smith)

CATOPSIS BERTERONIANA (Schultes) Mez. (*C. nutans* sensu L. B. Smith in  
Ann. Mo. Bot. Gard. 24:180. 1937; non Griseb. 1864). Material at Stockholm



Fig. 1. *Catopsis micrantha* L. B. Smith

labelled *Tillandsia nutans* by Swartz is actually *Catopsis Berteroniana*. Later, I learned that the type of his *Tillandsia nutans* is in the British Museum and is equivalent to *Catopsis fulgens*.

CATOPSIS micrantha L. B. Smith, sp. nov. (fig. 1).—Planta masculina solum cognita, florigera fere 1 m. alta; foliis multis, erectis, ad 23 cm. longis, margine haud albis, ad basin versus plus minusve cretaceis; vaginis quam laminis longioribus sed haud distinctis; laminis late ligulatis, 4 cm. latis, late acutis, apiculatis, supra sparse subtus dense punctulato-lepidotis; scapo erecto, gracili; scapi bracteis sub-

<sup>1</sup> Issued March 22, 1943.

foliaceis, dense imbricatis; inflorescentia laxa amplexu tripinnatim paniculata; bracteis primariis suboblongis, late acutis, quam ramis multo brevioribus; ramis divergentibus, 2 dm. longis; spicis elongatis, laxe multifloris; bracteis florigeris late ovatis, quam sepalis brevioribus; floribus masculinis sessilibus, patentibus; sepalis asymmetricis, latissime obovatis, 2 mm. longis; petalis 3.5 mm. longis, albis; staminibus inaequalibus.—BOCAS DEL TORO: epiphyte, hills behind Fish Creek, vicinity of Chiriquí Lagoon, April 16, *von Wedel 2236* (Gray Herb., TYPE).

In its imbricate scape-bracts, broad leaf-blades and small flowers, *Catopsis micrantha* appears most closely related to *C. Morreniana*. However, its staminate flowers are much smaller, its inflorescence more branched, and its leaves broader and without the conspicuous white margin of *C. Morreniana*.

CATOPSIS NITIDA (Hook.) Griseb.—CHIRIQUÍ: forest, Bajo Mono, Boquete District, alt. 1350 m., April 9, 1938, *Davidson 535* (Herb. Field Mus.); Boquete, Boquete District, alt. 1140 m., July 1, 1938, *Davidson 863*. Previously known from the Greater Antilles, Guiana, Guatemala, Honduras and Costa Rica.

GUZMANIA CORIOSTACHYA (Griseb.) Mez.—COCLÉ: hills north of El Valle, Jan. 13, 1942, *Allen 2945*. Previously known from Costa Rica, Colombia, and Venezuela.

GUZMANIA DONNELLSMITHII Mez ex Donn. Smith in Bot. Gaz. 35:9. 1903. (*Thecophyllum angustum* Mez & Wercklé in Bull. Herb. Boiss. II, 4:1121. 1904).

GUZMANIA NICARAGUENSIS Mez & C. F. Baker.—COCLÉ: north of El Valle de Antón, near La Mesa, alt. ca. 1000 m., Nov. 12, 1941, *Allen 2803* (Gray Herb.). Previously known from Guatemala, Nicaragua and Costa Rica.

PITCAIRNIA APHELANDRAEFLORA Lem.—BOCAS DEL TORO: on rock, hills behind Fish Creek, vicinity of Chiriquí Lagoon, April 22, 1941, *von Wedel 2282* (Gray Herb.). Previously known from Amazonian Brazil and Peru.

The Panamanian material has two narrow auricles at the base of the petal but is otherwise typical.

THECOPHYLLUM PEDICELLATUM Mez & Wercklé.—CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, alt. 1800 m., Feb. 17, 1938, *Davidson 307* (Herb. Field Mus.). Previously known from Costa Rica.

The Panamanian specimen has much larger leaves, branches and floral bracts than is usual, but it is too old to show whether these are supported by other characters which would distinguish it specifically.

TILLANDSIA ADPRESSA André var. TONDUZIANA (Mez) L. B. Smith.—CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, alt. 1800 m., Feb. 13, 1938, *Davidson 280*. Previously known from Costa Rica.

TILLANDSIA FASCICULATA Sw. var. CONVEXISPICA Mez.—CANAL ZONE: Barro

Colorado Island, Aug. 1928, *Chickering 63* (Herb. Univ. Michigan). Previously known from Jamaica, Mexico, British Honduras and Guatemala.

*TILLANDSIA FASCICULATA* Sw. var. *UNCISPICA* Mez.—BOCAS DEL TORO: Isla Colón, May 16, 1940, *von Wedel 118*; Water Valley, vicinity of Chiriquí Lagoon, Oct. 26, 1940, *von Wedel 1377*; same, Oct. 28, 1940, *von Wedel 1396*; Little Bocas, vicinity of Chiriquí Lagoon, July 13, 1941, *von Wedel 2528*. Previously known from Cuba, Santo Domingo, Saint Lucia and Guatemala.

*TILLANDSIA GUANACASTENSIS* Standley.—COCLÉ: vicinity of El Valle de Antón, alt. ca. 600 m., Dec. 10, 1939, *Allen 2060*. Previously known from Costa Rica.

*TILLANDSIA SINGULARIS* Mez & Wercklé.—COCLÉ: region north of El Valle de Antón, alt. ca. 1000 m., Jan. 13, 1942, *Allen 2898* (Gray Herb). Previously known from Costa Rica.

#### MORACEAE

(P. C. Standley)

*CLARISIA mollis* Standl., sp. nov.—Arbor 10-metralis, ramulis sat gracilibus sordido-ochraceis sparse pilosulis, internodiis elongatis; folia majuscula 1.5 cm. longe petiolata crasse membranacea; lamina obovato-oblonga ca. 25 cm. longa et 9-10.5 cm. lata, apice rotundata et abrupte caudato-acuminata, acumine obtuso fere 2 cm. longo, basi cuneato-acuta, remote inconspicue serrato-dentata, supra glabra, venis obscuris, subtus fere concolor ubique sed praesertim ad nervos venasque breviter molliterque sordido-pilosula, costa tenui prominente, nervis lateralibus utroque latere ca. 13 tenuibus angulo acuto adscendentibus prope marginem arcuato-conjunctis, venis prominulis laxae reticulatis; spicae masculae in axillis binae sessiles interdum bifidae usque 4.5 cm. longae dense multiflorae, bracteis parvis peltatis minute pilosulis.—BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Oct. 8, 1940, *H. von Wedel 1090* (Herb. Field Mus., TYPE; duplicate in Herb. Missouri Bot. Gard.)

Eight species of this genus are known, all except *C. mexicana* (Liebm.) Lanjouw in South America. *C. mollis* is related, apparently, to *C. mattogrossensis* Lanjouw, but is clearly distinct in its pubescence and leaf details. The available material, unfortunately, is incomplete and does not permit a satisfactory diagnosis of the species.

#### NYCTAGINACEAE

(P. C. Standley)

*NEEA pycnantha* Standl., sp. nov.—Frutex 4.5 m. altus, ramulis crassiusculis glabris; folia modica membranacea opposita ca. 2 cm. longe petiolata; lamina elliptico-oblonga vel ovato-oblonga paullo infra medium latissima 11.5-18.5 cm. longa 5-8 cm. lata longiuscule acuminata, basi acuta, glabra, supra lucida, nervis venisque non elevatis, subtus concolor, costa gracili elevata, nervis lateralibus

utroque latere ca. 12 angulo latiusculo adscendentibus gracillimis prominentibus; inflorescentia ut videtur deflexa cymoso-corymbosa 9.5 cm. longe pedunculata, pedunculo gracillimo glabro, ca. 6.5 cm. longa et aequilata laxe multiflora, ramis minutissime ferrugineo-puberulis; bracteae conspicuae patentes lineari-subulatae 2.5-3.5 mm. longae attenuatae minute puberulae, floribus sessilibus aggregatis; perianthium albescens tubulosum 7-9 mm. longum 2.5 mm. latum glabrum fauce paullo angustatum basi obtusum, dentibus late deltoideo-ovatis vix ultra 8 mm. longis.—BOCAS DEL TORO: Water Valley, region of Chiriquí Lagoon, Nov. 9, 1940, *H. von Wedel 1574* (Herb. Field Mus., TYPE; duplicate in Herb. Missouri Bot. Gard.).

The species has better characters than most members of this genus, and is noteworthy for the very numerous, small but conspicuous, slender, spreading bracts of the inflorescence.

*NEEA xanthina* Standl., sp. nov.—Arbor 9-metralis praeter inflorescentiam fere omnino glabra, ramis crassiusculis ochraceis, novellis minute adpresse ferrugineo-tomentulosis; folia parva opposita firme membranacea glabra, petiolo 5-7 mm. longo; lamina oblongo-elliptica prope medium latissima 5.5-8 cm. longa 2-3.2 cm. lata abrupte breviter acuminata, acumine obtuso, basi late acuta, supra sublucida, costa nervisque non elevatis, subtus concolor, costa tenui prominente, nervis lateralibus utroque latere ca. 8 tenerimis angulo latiusculo adscendentibus arcuatis, venis inconspicuis laxe reticulatis; inflorescentia parva laxe multiflora ut videtur erecta 3 cm. longe pedunculata, 2.5 cm. longa 3-5 cm. lata, bracteis minutis linearis-subulatis, ramis minute sparseque ferrugineo-puberulis; flores flavescens graciliter pedicellati, pedicellis rubris 2-4 mm. longis; perianthium ellipsoideum 5 mm. longum 2-2.5 mm. latum sparse minutissime puberulum vel fere glabrum, apice contractum, dentibus late deltoideis minutis, basi acutiusculum.—BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, Feb. 4, 1941, *H. von Wedel 1970* (Herb. Field Mus., TYPE; duplicate in Herb. Missouri Bot. Gard.).

An inconspicuous plant, without any outstanding specific characters, but unusual among Panama species of *Neea* because of the very small leaves and small flowers.

#### ANNONACEAE

*XYLOPIA bocatorena* Schery, n. sp. — Arbor, ramis juventute dense brevissimeque pubescentibus pilis brunneo-flavis demum glabris brunneis lenticellis prominentibus; foliis distichis alternatis elliptico-lanceolatis apice attenuatissimis basi acutis 8-11 cm. longis 2.3-3.5 cm. latis, petiolis 2-3 mm. longis supra sulcatis glabrisque subtus rotundatis pubescentibusque; laminis supra glabris costa aliquid immersa subtus aliquid pubescentibus pilis adpressis, nervis lateralibus reticulatis confluentibus; floribus ovoideis axillaribus solitariis, pedicellis 5-6 mm. longis bracteis 2 emarginatis vel bilobatis; calyce cupuliformi 6-8 mm. diametro extus pubescente intus glabro, lobis 3 deltoideo-ovatis; petalis exterioribus valvatis ovato-lanceolatis extus pubescentibus intus brevi-pubescentibus ca. 12 mm. longis

ca. 6 mm. latis, petalis interioribus valvatis cum exterioribus alternantibus ca. 11 mm. longis 4-5 mm. latis; staminibus numerosis linearibus 3 mm. longis, antheris 1 mm. latis, carpellis linearibus ca. 8 centro calycis affixis 2-3 mm. longis apice brevi-subhirsutis basi pubescentibus; fructibus 1-4 ex pedicello rubris obovoideo-clavatis dehiscentibus ca. 2 cm. longis, seminibus 2 nigris.—BOCAS DEL TORO: Isla Colón, Nov. 16, 1941, *H. von Wedel 2965* (Herb. Missouri Bot. Gard., TYPE).

This species resembles the descriptions of *X. brasiliensis* Spreng. and *X. amazonica* Fries. It differs from the former, to which it keys in Fries' revision of *Xylopia* (Acta Hort. Berg. 10:86-214. 1931), in having wider leaves more rounded at the base, and a distinctly cupuliform calyx. From *X. amazonica* it differs in having less pubescent leaves, larger flowers, etc. The flowers are solitary on short pedicels, the pedicels bearing a larger emarginate or cleft upper bract and a similar smaller lower bract oriented at about 120° angle from the upper one. The separate carpels each bear terminally a lightly white-hirsute style. At full maturity of the flower the carpels are golden-brown at the base. The fruit is red, obovoid or subclavate, slightly constricted between the 2 seeds, and with a barrowed basal stipe 2-5 mm. long. The pericarp splits down one side, exposing the black seeds.

*CYMBOPETALUM magniffructum* Schery, n. sp.—Arbor 12 m. alta, ramis juventute dense pubescentibus demum glabris in sicco rugosis griseis; foliis alternatis, petiolis 2-3 mm. longis pubescentibus supra planis; laminis parvis (juventute (?) 3-4 cm. longis) ovatis apice basique acutis in petiolo decurrentibus leviter pubescentibus vel glabris; floribus solitariis, pedicellis pubescentibus angulatis ebracteatis 2.5-3.0 cm. longis, sepalis 3 ovato-triangularibus, majoribus 4-5 mm. longis leviter pubescentibus, petalis interioribus 3 obovatis majoribus levitissime pubescentibus ca. 17 mm. longis 12 mm. latis apice truncato-inflexis basi incrassatis; staminibus multis linearibus apice truncatis 2.5 mm. longis longitudinaliter bilocularibus, carpellis ca. 14 linearibus apice dense pubescentibus truncatis ca. 2.5 mm. longis, toro rotundato-convexo; fructu magno obovoideo glabro lepidoto nigro 6 cm. longo 4 cm. lato, pericarpio crasso dure-coriaceo; seminibus 6 semilunatis 2.5 cm. longis.—PANAMÁ: vicinity of Bejuco, alt. ca. 50 m., May 6, 1941, *P. H. Allen 2455* (Herb. Missouri Bot. Gard., TYPE).

The Allen specimen is so distinct from previously known species of *Cymbopetalum* that placing it to the genus was rather difficult. However, Dr. P. C. Standley agrees that this plant could scarcely be placed elsewhere than in *Cymbopetalum*. The plant is characterized by the moderately short pedicels, distinctive flowers, and extremely large, obovoid fruit. It appears doubtful that the small leaves of the type specimen have reached mature size, since they are found only on the young lateral branches. The fruit has a very thick (1.5-3.0 mm.) leathery pericarp, black and minutely lepidote on the outside. The 6-7 large seeds are closely packed and are covered with a fleshy matrix which when dry has the color and odor of prunes.

## SAXIFRAGACEAE

*PHYLLONOMA RUSCIFOLIA* Willd.—CHIRIQUI: Cerro Horqueta, cloud forest, April 26, 1940, C. von Hagen & W. von Hagen 2043. Described by the collectors as "Tree 20'; fruit white, odorless, attached to rib of leaf."

The peculiar genus *Phyllonoma*, characterized superficially by the adnation of a cluster of minute flowers high on the leaf blade, has been reported from Mexico, Guatemala, Costa Rica, Colombia, and Peru. A general discussion of the speciation, but unfortunately not a very clear one, is given by Pittier (Contr. U. S. Nat. Herb. 12:172-174. 1909). From this account, incidental to the description of two new species from Costa Rica, and from the relatively few herbarium specimens available for the entire genus, we suspect that the variability of the genus is not yet satisfactorily understood, and are identifying our specimen, provisionally, with the earliest binomial (as illustrated by Kunth under *Dulongia acuminata* in HBK. Nov. Gen. & Sp. 7: pl. 623. 1825). Our material is rather copious, and upon its branches one may find some leaves which are essentially entire and others with 1, 2, or 3 acuminate teeth. The flowers, also, vary in their arrangement, some with pedicels springing directly from the leaf and others borne upon short racemose peduncles.

## LEGUMINOSAE

*MACROLOBIUM modicopetalum* Schery, n. sp.—Arbor, ramis novellis subglabris vetustioribus glabris; foliis 1-jugatis glabris, petiolis brevibus (3-10 mm. longis) teretibus profunde canaliculatis; laminis coriaceis sessilibus vel petioulis ad 3 mm. longis ellipticis basi inaequaliter subacutis apice breviter attenuatis et obtuse mucronatis 12-23 cm. longis 4-9 cm. latis, nervis supra subplanis subtus prominentibus, nervis lateralibus perspicue confluentibus; inflorescentiis spicatis glabris vel brevissime pubescentibus plerumque ex ramis vetustioribus, alabastris obovoideis ca. 5 mm. longis; floribus ca. 16 anguste pedicellatis basi bracteo subpersistente obovato vaginato bilobato 7-9 mm. longo lobis ca. 4 mm. latis, sepalis 4 oblongis apice obtusis glabris imbricatis 6-7 mm. longis 2.5-4.0 mm. latis, petalo 1 albo ovato-lanceolato concavo margine perspicue undulato-inhirescente 12-13 mm. longo 6-8 mm. lato brevissime unguiculato; staminibus 3, sepalis ventralibus oppositis, filamentis glabris linearibus 11-19 mm. longis, antheris ovatis bilocularibus versatilibus ca. 3 mm. longis 2 mm. latis; ovario compresso ovato-lunato ca. 3 mm. longo ad margines pubescente ad confluentem sepalorum substipitato, ovulis 4 ovatis ca. 0.7 mm. longis; stylo glabro cum ovario 16-20 mm. longo, stigmate terminali certe capitato pubescente.—BOCAS DEL TORO: Fish Creek, Apr. 15, 1941, H. von Wedel 2226 (Herb. Missouri Bot. Gard., TYPE); same locality, Apr. 9, 1941, H. von Wedel 2209; Apr. 22, 1941, H. von Wedel 2291; May 7, 1941, H. von Wedel 2399 (Herb. Missouri Bot. Gard., COTYPES).

*Macrolobium modicopetalum* falls into the section VOUPA of the genus. It resembles several of the unijugate species such as *M. floridum* Karst., *M. ischno-*

*calyx* Harms, *Vouapa Pittieri* Rose (ex char.), etc. In Martius (Fl. Bras. 15<sup>2</sup>:219. 1870) it keys near *M. punctatum* Spruce, and judging from available descriptions alone it apparently differs from newer Brazilian species. This is to be expected, as Britton and Killip (N. Y. Acad. Sci. 35:166. 1936) include only one species from Colombia (*M. floridum*) in their genus *Macrolobium*, within which *M. modicopetalum* obviously belongs. *M. modicopetalum* differs from *M. floridum* in having 4 rather than 5 ovules, glabrous rather than pilose bracts and styles, attenuate rather than acute leaf blades, inflorescences generally on older wood rather than terminal, etc. *M. modicopetalum* differs from *Vouapa Pittieri* (the only species listed from North America by Britton and Rose, N. Am. Fl. 23:226. 1930) in having smaller leaves and the petal 1.3 cm. rather than 4.0 cm. long.

Were not *M. modicopetalum* from a region where this preponderantly Brazilian genus is very rare, one would hesitate to describe it without first seeing authentic material of related species, for it is often difficult, as well as tedious, to distinguish these species by description alone. However, *M. modicopetalum* is clearly different from all Colombian, Venezuelan and other North American species known to me.

The following characters are helpful in distinguishing this species: (1) moderately large, unijugate, glabrous leaves, (2) inflorescences usually not terminal, (3) conspicuous, glabrous pedicellar bract, cleft about half its length, (4) moderate-sized, scarcely-clawed petal, (5) glabrous style, filaments, petal and sepals, (6), 4-ovulate ovary.

*LONCHOCARPUS monofoliaris* Schery, n. sp.—Arbor ramis teretibus glabris; foliis alternatis unifoliatis, stipulis non visis, petiolis (rhachide incluso) 8–9 mm. longis subglabris basi plus minusve teretibus apice supra profunde canaliculatis, petiolulis subglabris 2–3 mm. longis supra canaliculatis; laminis glabris elliptico-lanceolatis basi acutis vel obtusis apice obtuse brevi-mucronatis, supra planinervatis subtus costa prominente nervis lateralibus ca. 12 arcuatis; inflorescentiis axillaribus spicato-paniculatis 5–12 cm. longis, pedunculis primariis leviter subpubescentibus, pedunculis secundariis subpubescentibus 1–2 mm. longis apice plerumque pedicellos binos pubescentes 1–2 mm. longos minute 2-bracteolatos gerentibus, bracteis parvis 0.5–1.0 mm. longis, lanceolatis; calyce turbinato cupuliformi breviter 5-dentato pubescente ca. 1.5 mm. alto 3–4 mm. lato; vexillo orbiculari-subauriculato extus pubescente apice retuso basi subauriculato, ungue ca. 1.5 mm. longo, alis ungue ca. 3 mm. longo, limbo elliptico ca. 7 mm. longo ca. 3 mm. lato, carinis ungue ca. 3 mm. longo, limbo obovato-elliptico 6–7 mm. longo ca. 2.5 mm. lato; filamentis omnibus coalitis, columna glabra cylindrica basi 2-fenestrata, fenestrae marginibus lateralibus callosis; antheris bilocularibus lanceolatis versatilibus; ovario lineari compresso 3-ovulato pubescenti marginibus inferioribus superioribusque aequicrassis; stylo brevi-pubescente; stigmatibus terminali parvo glabro.—BOCAS DEL TORO: Water Valley, Sept. 11, 1940, *H. von Wedel*

699 (Herb. Missouri Bot. Gard., TYPE); same locality, Sept. 23, 1940, H. von Wedel 910 (Herb. Missouri Bot. Gard., COTYPE).

This species is especially distinguished by its unifoliate leaves, a character shared to the best of my knowledge by only two other species in the genus and by only four or five genera in the Dalbergieae. Although no fruit is here available for definite generic location of this material, it could scarcely fall elsewhere than in *Lonchocarpus*. It possesses all the characters listed for that genus by Pittier (Contr. U. S. Nat. Herb. 20:38. 1917), and also compares well with various floral illustrations of *Lonchocarpus*. In Pittier's subdivision of the genus, *L. monofoliolaris* keys to subgenus EULONCHOCARPUS, series PLANINERVI, section EPUNCTATI. The species it comes near is the Mexican *L. unifoliolatus* Benth., from the description of which it differs by having shorter petiolules, an orbicular-subauriculate rather than ovate standard, a cylindric rather than a broadly dilated staminal tube, blue or purple rather than pink flowers, etc.

The flowers are borne in gracefully curved spike-like panicles, the panicles occurring singly in the axils of the leaves. The short pedicels are attached to the expanded apex of the peduncles, a pair to each peduncle. At the base of the calyx two small ovate bracts are borne laterally. The calyx is shallow and very briefly 5-dentate, the 2 upper dentations being approximate. The standard is retuse apically, pubescent on the back, and bears a thick crescent-shaped ridge at the base running from "auricle" to "auricle" just above the juncture with the claw. The keel petals are joined on their lower margin and are closely invested by the wings to which they seem to adhere but are not organically attached. The androecium consists of ten more or less alternating long and short stamens, the filaments of which are united into a monadelphous tube. At the base of the tube are two fenestrae, one on either side of the vexillar filament, each of which has a thick callous at its lateral margin. The vexillar filament appears to be very insecurely attached to the receptacle. The laterally compressed ovary is only 3-ovulate, the ovules being attached to the thick upper margin. The structure of the ovary suggests that the fruit has wide margins at the juncture of the valves, but is not especially thickened at the point of attachment of the seeds.

*ORMOSIA stipitata* Schery, n. sp. (fig. 2).—Arbor ca. 15 m. alta, ramis glabris vel juventute leviter aureo-pubescentibus brunneis subangulatis in sicco longitudinaliter rugosis, lenticellis albis ovalibus prominentibus; foliis suboppositis 5-9-foliolatis, petiolis crassis in sicco irregulariter rugosis supra planis pubescentibus subtus teretibus subglabris cum rhachidibus 11-17 cm. longis, petiolulis teretibus nigris crassis pubescentibus 6-8 mm. longis, foliolis suboppositis; laminis ellipticis vel elliptico-lanceolatis basi acutis vel obtusis apice acutis breviter obtuseque attenuatis supra plus minusve glabris, nervis planis subtus aureo-pubescentibus pallidis, costa prominente nervis lateralibus subprominentibus plerumque 12-16; inflorescentiis spicatis angulatis arcuatis aureo-pubescentibus 10-18 cm. longis terminalibus et ex folium apicalium axillis, bracteis minutis lanceolatis ca. 1

mm. longis, pedicellis erectis 5-6 mm. longis apice subrevolutis et aliquid clavatis, alabastris levitissime imbricatis 4-5 mm. latis; calyce dense pubescente ca. 1 cm. in diametro basi tubo substipitato apice, lobis triangularibus subaequalibus ca. 4 mm. latis; vexillo obcordato profunde retuso (vagina ca. 3.5 mm. longa) glabro ca. 15 mm. longo et lato ungue crasso ca. 5 mm. longo, alis glabris oblongo-lunatis lamina ca. 11 mm. longa ungue ca. 3 mm. longo, carinis oblongis glabris (margine inferiore breviter brunneo-pubescente) lamina ca. 13 mm. longa ungue ca. 3 mm. longo; staminibus 10 liberis cum brevibus et longis alternantibus, filamentis glabris lanceolato-linearibus 9-15 mm. longis basi 1.0-1.5 mm. latis calycis tubo affixis, antheris versatilibus breviter oblongis bilocularibus 1.0-1.5 mm. longis; ovario ovato lateraliter aliquid compresso dense pubescente ca. 6 mm. longo 4-ovulato

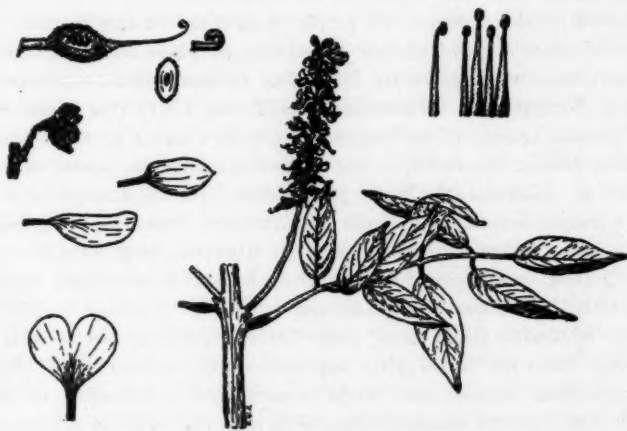


Fig. 2. *Ormosia stipitata* Schery

stipitato (stipite 4 mm. longo basi calycis tubo inaequaliter adnato) supra sub-tusque marginibus latis; stylo glabro apice inflexo, stigmate sublaterali bilobato.—CHIRIQUÍ: between Remédios and David, March 16, 1940, *Peggy White* 306 (Herb. Missouri Bot. Gard., TYPE).

The type of *Ormosia stipitata* is reported as growing in open sunlight beside a river and as having a trunk 3-5 dm. in diameter. The young branches are quite stout and conspicuously longitudinally ridged in the dried state; they broaden laterally to the origin of petiole and peduncle. The terminal leaves are 5-foliolate, the subterminal ones up to 9-foliolate, which suggests that leaves of the older or lower branches are at least 9-foliolate. The dry leaflets are dull olive above and pallid below, with appressed golden pubescence on the lower surface. The whole branch tip forms a leafy "inflorescence", a few peduncles arising terminally and others singly from the axils of the upper leaves. Each is gracefully arcuate upward. The bracts subtending the pedicels are minute and scale-like.

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The standard is lavender while the other petals are white. In the type specimen the topmost flowers of the peduncles are in bud, while immediately below this are found flowers with expanded petals, and on the basal half of the peduncle flowers from which the petals have fallen. In these lower flowers the stipitate ovary with the persistent style greatly protrudes from the calyx.

The filaments are entirely free and are attached in a circle to the upper part of the narrowed stipe-like calyx base, with the vexillar filament similar to the others. Wider and longer stamens alternate with shorter and narrower ones, although not all of either cycle are equally long. The basal part of the ovary stipe is briefly adnate above to the base of the calyx tube. The style is inflexed apically and in age is almost coiled. The young stigma is borne laterally at the very tip of the style and consists of 2 semi-circular knob-like parts.

Placement of this species to the proper genus is not an easy matter. Certainly in Bentham's time it could scarcely have fallen elsewhere than in *Ormosia* as the tribe SOPHOREAE was known by him. But in more recent treatments of the tribe (e. g. Taubert, Nat. Pflanzenfam. 3<sup>3</sup>:186-199. 1891) this species would not key to *Ormosia* because of its long-stipitate ovary; rather it would seem to fall near *Alexa*, *Dussia*, *Bowdichia*, or one of several monotypic genera not native to the Americas. However, the White plant differs from the description of *Alexa* in lacking a sinuate-dentate calyx, linear anthers, many ovules, and unpaired leaflets; from *Dussia* in lacking 9 coalesced (at base) filaments, large inflorescence bracts, terete (?) fruit, and unpaired leaflets; from *Bowdichia* in lacking many ovules, many leaflets, and linear weakly winged fruit (?). Neither is it *Vexillifera* (synonym of *Dussia* fide Harms), nor *Casbalia* (type species of this genus a synonym). Thus the White plant appears to differ more radically from other genera than from *Ormosia* and should be considered as belonging to this genus, especially in that several species of *Ormosia* have ovaries stipitate in various degrees.

Among species of *Ormosia*, *O. stipitata* appears to fall somewhat near *O. fastigiata* Tul. in the section BICOLORES. It keys near that species or closely related species in the treatments of both Bentham (Mart. Fl. Bras. 15<sup>1</sup>:319. 1862) and of Ducke (Archiv. Jard. Bot. Rio de Janeiro 4:61-71. 1925). It seems to fit no adequately described species of *Ormosia* and certainly fits no described species of *Dussia*. Perhaps *Ormosia panamensis* Benth. from the Panama region may prove to be the same, but it differs in description from *O. stipitata* in having the leaflets pubescent above. The description of *O. panamensis* is taken by Seemann (Voyage of the Herald, p. III. 1853) from Bentham's manuscript and is entirely inadequate for complete comparison, nor is there a specimen of this species in the herbarium of the Missouri Botanical Garden. Since *O. stipitata* is poorly represented by duplicate specimens it is here illustrated (fig. 2).

**SWARTZIA nuda** Schery, n. sp.—Arbor vel arbuscula fere omnino glabra, ramis teretibus; foliis alternatis, 5 (raro 3)-foliolatis (petiolis rhachidibus inclusis) 10-13 cm. longis supra planis 2-3-striolatis basi nigro-callosis, nodulis aliquid tumidis,

petiolulis 4–8 mm. longis teretibus nigro-callosis supra canaliculatis; laminis ellipticis 14–32 cm. longis 6–13 cm. latis basi acutis vel obtusis apice acutis breviter attenuatis, nervis supra planis, subtus costa et nervis lateralibus prominentibus leviter scarioso-pubescentibus, nervis lateralibus ca. 12–20 arcuatis confluentibus; inflorescentiis axillaribus (1–3 ex ramis vetustioribus) spicatis multifloris 5–16 cm. longis leviter brevi-pubescentibus, pedicellis 1.0–1.5 cm. longis, alabastris globularibus ca. 6 mm. diametro 3–5-lobatis, floribus apetalis; staminibus numerosis plus minusve 2-seriatis plerisque 1–1.5 cm. longis aliquot 1.9–2.1 cm. longis, filamentis filiformibus glabris, antheris oblongis bilocularibus suberectis, brevioribus 1.5–1.8 mm. longis, longioribus 2.0–2.5 mm. longis; ovario lineari stipitato 2–3 cm. (stylo incluso) longo, ovulis ca. 13 obovato-lunatis sub-terminaliter funiculatis; stylo arcuato 6–7 mm. longo, stigmate terminali truncato-capitato; fructu elongato 12–20 cm. longo subterete tarde dehiscente basi stipitato apice attenuato, loculis 1–2 elliptico-lunatis 1.3–2.0 cm. latis constrictionibus interocularibus 0.2–1.0 cm. latis, seminibus 1–2-arillatis linearibus ca. 5 cm. longis 0.7 cm. latis.—BOCAS DEL TORO: Isla Colón, Oct. 18, 1940, *H. von Wedel 1224* (Herb. Missouri Bot. Gard., TYPE); same locality, Oct. 8, 1940, *H. von Wedel 1073*; Oct. 9, 1940, *H. von Wedel 1107*; Water Valley, Sept. 23, 1940, *H. von Wedel 909*; Sept. 24, 1940, *H. von Wedel 957*; Nov. 21, 1940, *H. von Wedel 1727* (Herb. Missouri Bot. Gard., COTYPES).

*Swartzia nuda* appears to fall in Bentham's section ORTHOSTYLEAE but does not closely resemble any known Panamanian species. In Britton and Rose's treatment of the genus (N. Am. Fl. 23<sup>6</sup>:347. 1930), it keys to *Swartzia (Tounatea) caribaea* Griseb., from which species it differs markedly in size and shape of the leaflets and fruit. In Britton and Killip's work on Colombian Caesalpiniaceae (Ann. N. Y. Acad. Sci. 35: 1936), *S. nuda* does not fit any species in the key. Drs. Killip and Macbride, who have seen a fruiting specimen of *S. nuda*, feel certain that they have never encountered it in their South American work.

*Swartzia nuda* is especially distinctive in the following characters: (1) complete glabrescence of most parts, (2) very large leaflets with conspicuously confluent lateral veins, (3) spicate inflorescences from non-foliate nodes, (4) apetalous flowers, (5) long, slender, glabrous ovary and style, (6) very large, elongate, subterete fruit, which is often 2-locular with a marked constriction between the locules, (7) very long, slender, conspicuously arillate seeds.

#### MALPIGHIACEAE

*BANISTERIOPSIS scalariformis* Schery n. sp.—Planta arborescens (vel aliquid volubulis?), ramis glabris teretibus porphyreis in sicco longitudinaliter substriatis; foliis oppositis vel suboppositis, stipulis subinterpetiolaribus minutis deciduis, petiolis glabris ca. 5 mm. longis 1–1.5 mm. diametro supra canaliculatis; laminis glabris coriaceis ovatis vel ellipticis basi obtuse rotundatis biglandulosisque apice acuminatissimis in sicco supra porphyreis subtus brunneis, costa supra impressa subtus prominente, nervis lateralibus secundariis subparallelis scalariformibus ad

costam perpendicularibus; inflorescentiis terminalibus vel axillaribus leviter pubescentibus, bracteis primariis lanceolatis ca. 6 mm. longis bracteis secundariis minutis lanceolatis vel trilobatis; floribus ultimis plerumque 4-umbellatis, pedicellis gracilibus ca. 1 cm. longis; calyce glabro 8-glanduloso 5-lobato, lobis ovatis lobo maximo 3 mm. alto et lato, glandibus 1-2 mm. longis; petalis glabris, unguibus linearibus 2-3 mm. longis, limbis cupuliformibus margine fimbriatis petalis maximis ca. 5 mm. longis, petalis minimis ca. 3 mm. longis, floris minimi limbo basi biglanduloso; staminibus 10 glabris 2-4 mm. longis minoribus juxta petalo minimo, filamentis liberis linearibus basi confluentibus, antheris obovato-oblancoatis bilocularibus connectivo crassissimo; stylo glabro lineari brunneo ca. 3 mm. longo apice stigmatate subcapitato luteo; carpellis 3 subglabris triangularibus uniovulatis basi confluentibus.—BOCAS DEL TORO: Western River, Sept. 27, 1941, *H. von Wedel* 2776 (Herb. Missouri Bot. Gard., TYPE); same locality and date, *H. von Wedel* 2791 (Herb. Missouri Bot. Gard., COTYPE); Fish Creek lowlands, May 3, 1941, *H. von Wedel* 2378 (Herb. Missouri Bot. Gard., COTYPE).

It is with temerity that this species is described as *Banisteriopsis*. First, the generic bounds in the Malpighiaceae are very confused, and various authors have persistently considered different genera as valid. Second, although this material was kept on hand for almost a year in the hope that material in fruit would turn up, no such specimens have yet become available. This is unfortunate, since in this family division into genera is based largely upon fruit characters. However, comparison of the Wedel specimens with all Malpighiaceae plants in the Missouri Botanical Garden herbarium showed no match; neither could the specimens be keyed-out in Small's monograph (N. Am. Fl. 25. 1910) nor in Niedenzu's monograph (Pflanzenreich IV. 141. 1928) of the Malpighiaceae. Nor could the plant be satisfactorily located in Standley's 'Flora of Costa Rica', Standley's 'Flora of the Canal Zone', nor in Martius' 'Flora Brasiliensis.' Apparently the species has never been described, but future monographic work or future collections may necessitate its transfer to another genus. In Small's monograph the Wedel specimens key to *Banisteriopsis lucida*, from which they differ especially in lacking such large flowers and the ferrugineous pubescence of the lower leaf surface. In Niedenzu's monograph the specimens key to the Brazilian *Banisteria schizoptera*. Morton considers *Banisteria* of Niedenzu to be the same as *Banisteriopsis* of Robinson (Proc. Biol. Soc. Wash. 43:159. 1930). In the herbarium the Wedel specimens resemble *Banisteriopsis inebrians* Morton from Colombia.

This species is distinguished from most Malpighiaceae plants by the subparallel scalariform appearance of the secondary lateral veins. The leaf blade in the dry state usually appears red-brown above and brown below. On either side of the costa on the lower surface of the blade, at the juncture of the petiole, is found a small ovate gland. A pair of glands is similarly found at the base of the blade of the primary inflorescence bracts. These bracts are generally entire, although sometimes with 3 or 4 large dentations apically. The ultimate flower clusters are umbellate with usually 4 flowers on slender pedicels. The flowers are

essentially glabrous throughout, and slightly zygomorphic, usually with 2 large petals, 2 slightly smaller ones, and 1 small petal bearing 2 glands at the base of its limb. Apparently the stamens are somewhat shorter on the side next the small petal. The connective of the anthers is very bulky, usually dwarfing the pollen chambers. The styles are linear and slightly expanded apically into a truncate-subcapitate stigma. The carpels are easily separable and bear what appears to be a primordial wing or ridge externally. In two collections the plant has been described as a tree with yellow flowers and in the other as a vine with purple flowers.

## ICACINACEAE

*LERETIA CORDATA* Vell.—BOCAS DEL TORO: Fish Creek Hills, May 12, 1941, *H. von Wedel* 2443. Previously known from Brazil and British Guiana (?). The von Wedel specimen in question was first considered different enough from the description of *L. cordata* to warrant publication as a new species. It differs in having glabrous rather than red-brown pubescent (glabrous in age) stems, shorter (5-6 mm.) rather than longer (8-15 mm.) petioles, elliptic rather than ovate-lanceolate leaves, essentially glabrous rather than pubescent lower leaf surface, 4-6 rather than 6-8 main lateral veins, brown rather than golden inflorescences, pedicels usually shorter than in the description, and ovary entirely pubescent rather than with a disc-like glabrous base. No rudimentary styles are found as seems to be the general condition with the species. Also L. B. Smith was unable to find a completely satisfactory match for the plant at the Gray Herbarium where some of R. A. Howard's annotated specimens are on deposit.

Yet examination of published illustrations, herbarium specimens, and reference to Howard's monograph of the genus (*Jour. Arn. Arb.* 23:58-60. 1942) show this monotypic genus (fide Howard) to be exceedingly variable. Variations do occur which apparently cover all the above-mentioned differences between the von Wedel specimen and Howard's description of the species. Thus the specimen evidently is *L. cordata* and should be considered as a new record for the genus north of South America.

## BEGONIACEAE

(*L. B. Smith & B. G. Schubert*)

*BEGONIA CONCHAEFOLIA* Dietr. (*B. pumilio* Standl.)—COCLÉ: vicinity of El Valle de Anton, *Allen* 2925. Also known from Costa Rica.

*BEGONIA PITTIERI* C. DC.—COCLÉ: La Mesa, Aug. 31, 1941, *Allen* 2722. Previously known from Costa Rica.

## MYRTACEAE

*CALYPTRANTHES tumidonodia* Schery, n. sp. — Arbuscula, ramis novellis teretibus nodis tumidis duplo latior ramorum internodiis; foliis oppositis magnis glabris breve-petiolatis, petiolis 5 mm. longis furfuraceis supra subcanaliculatis; lamina ellipticis 12-28 cm. longis 5-9 cm. latis apice longe acuminatis vel caudatis,

costa supra indentata subtus prominente, nervis lateralibus parallelis vel subarcuatis ad margines confluentibus; inflorescentiis plerumque 2 ex nodo terminali vel penultimo brunneo-pubescentibus cymosis 3-4 plo divis; floribus subsessilibus apetalis albis, tubo turbinato-cupuliformi extus lepidoto 3 mm. lato 2 mm. alto, limbo calyptriformi circumscissili 1 mm. alto; staminibus multis ad marginem tubi affixis, filamentis linearibus 5 mm. longis, antheris versatilibus bilocularibus 0.2 mm. latis; stylo lineari 4-5 mm. longo; ovario inferiori plerumque triloculari, loculo basi uniovulato.—BOCAS DEL TORO: Fish Creek Hills, Apr. 9, 1941, *H. von Wedel* 2195 (Herb. Missouri Bot. Gard., TYPE); same locality, Apr. 14, 1941, *H. von Wedel* 2223 (Herb. Missouri Bot. Gard., COTYPE).

This species is distinctive in a poorly-known genus by virtue of its large leaves, swollen nodes, and inflorescence and floral characters. The inflorescence is cymose and regularly 3-4 times divided so that the peduncle divides into 3 secondary peduncles, each of which divides into 3 tertiary peduncles, and these in turn bear either 3 quarternary peduncles or 3 short-petiolate flowers. The inflorescence much resembles that found in certain species of *Psychotria*. Apparently 2 inflorescences are usually borne together from the terminal node, although sometimes a single inflorescence arises from the terminal or penultimate node. The flower is apetalous and consists of a turbinate-cupuliform base or tube and a circumscissile calyptriform limb or cap which is shed before the stamens unfold. The stamens are attached to the margin of the tube and are infolded in bud in such a manner that the upper half of the filament is pressed against and parallel to the style, the anther resting near the style base. The many filaments may be partially adnate towards the base. The style is linear and somewhat coiled in bud. The ovary is usually indistinctly 3-locular, although occasionally 4-locular. Each locule contains a single ovule borne basally.

## RUBIACEAE

(P. C. Standley)

*HOFFMANNIA AERUGINOSA* Standl.—BOCAS DEL TORO: Fish Creek Hills, April 22, 1941, *H. von Wedel* 2289. Described from Costa Rica.

*MORINDA CITRIFOLIA* L.—BOCAS DEL TORO: Isla Colón, Nov. 14, 1941, *H. von Wedel* 2942. Apparently the first record from continental North America. Previously known from Asia, Australia and the Pacific islands.

*PSYCHOTRIA SOLITUDINUM* Standl.—BOCAS DEL TORO: Fish Creek Hills, April 24, 1941, *H. von Wedel* 2323. Described from Costa Rica.

